REPORT OF THE SUPERINTENDENT

OF THE

U.S. COAST AND GEODETIC SURVEY

SHOWING

THE PROGRESS OF THE WORK

DURING THE

FISCAL YEAR ENDING WITH

JUNE, 1895.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1896.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

The Report of the Superintendent of the United States Coast and Geodetic Survey, stating progress made in that work during the fiscal year ending June 30, 1895.

TREASURY DEPARTMENT, OFFICE OF THE SECRETARY,
Washington, D. C., December 9, 1895.

SIR: In compliance with the requirements of section 4690, Revised Statutes, I have the honor to transmit herewith, for the information of Congress, a report addressed to this Department by W. W. Duffield, Superintendent of the United States Coast and Geodetic Survey, showing the progress made in that work during the fiscal year ended June 30, 1895, and accompanied by maps illustrating the general advance in the operations of the Survey up to that date.

Respectfully, yours,

J. G. CARLISLE,
Secretary.

The VICE-PRESIDENT OF THE UNITED STATES,
AND PRESIDENT OF THE SENATE.

LETTER OF TRANSMISSION.

UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., December 8, 1895.

SIR: In conformity with law and the regulations of the Treasury Department I have the honor to submit herewith, for transmission to Congress, the Annual Report on the progress of the Coast and Geodetic Survey for the fiscal year ending June 30, 1895. It is accompanied by maps illustrating the general advance in the field work of the Survey up to that date.

Very respectfully, yours,

W. W. DUFFIELD,
Superintendent.

Hon. J. G. CARLISLE,
Secretary of the Treasury.

REPORT OF THE SUPERINTENDENT

OF THE

U. S. COAST AND GEODETIC SURVEY

FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

IN TWO PARTS.

PARTS I AND II.

PREFATORY NOTE.

In this report of the fiscal year 1895 the division into two parts has been retained, but both parts are published in one volume. The octavo form for Part II, while possessing some advantages, has been found unsuitable for some of the scientific and professional papers, especially those requiring extended tables, and the quarto form is therefore readopted.

Part I contains the historical portion. It presents abstracts of progress in field and office work, gives estimates for future work, and a statement of expenditures during the fiscal year.

Part II contains the Appendixes which relate to the methods, discussions, and results of the Survey, with such illustrations as are required.

The usual maps and progress sketches, showing in detail the localities and scope of the field operations, accompany the report; they belong properly to Part I, but for convenience follow after Part II. The illustrations accompany the Appendixes to which they respectively belong.

ABSTRACT OF CONTENTS OF REPORT.

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REPORT.

PART I.

INTRODUCTORY STATEMENT.

During the fiscal year 1895 upward of seventy-five parties were actively engaged on the various branches of the field work of the Survey, and these were widely distributed, their fields of operation embracing the Atlantic, Gulf, and Pacific coasts, Alaska, and the interior of the country. Work was carried on within the limits or on the coasts of sixteen States and Territories along the seaboard and in nine States and Territories in the interior. It included reconnaissance, base-line measures, triangulation, topography, hydrography, physical hydrography, time, latitude, longitude, and azimuth determinations, boundary-line surveys, geodetic leveling, magnetic declination, dip and intensity observations, laying out of meridian lines, gravity determinations, tidal and current observations, oyster-bed surveys, etc.

Among the works of special importance may be mentioned the completion of the topographic and hydrographic resurvey of Boston Harbor and vicinity; the continuation of the Hudson River survey; the beginning of the topographic and hydrographic resurvey of Buzzards Bay; geodetic and other leveling in various sections of the country; the continuation of the hydrographic surveys in Nantucket Sound; and hydrographic examinations in Long Island Sound and Delaware and Chesapeake bays; the continuation of telegraphic longitude determinations, principally in the southwest; the completion of the resurvey of Pensacola Bay and its tributaries; the continuation of the transcontinental triangulation in Colorado; the continuation of the oblique arc in Alabama; furnishing points in aid of State surveys in Tennessee, Kentucky, New Jersey, and Minnesota; surveys in the vicinity of Charleston, S. C.; the completion of the reconnaissance of the Rio Grande from its mouth to El Paso; and progress made in the regular Alaskan hydrographic surveys; in the preliminary surveys for the location of the boundary line between southeastern Alaska and British Columbia; in the survey of the California and Nevada oblique boundary line, and in the topographic and hydrographic resurvey of San Francisco Bay and Harbor.

For the United States Commissioner of Fish and Fisheries a further examination was made relative to the natural oyster beds of Mobile Bay and vicinity, and the similar work carried on in the waters of Virginia at the request of the State authorities was brought to a completion.

In the general statement of progress given on the following pages will be found a reference to each piece of work executed during the year, and in Table No. 1 the same information is given in more condensed form. Under the heading "Abstracts of reports from field parties" will be found a detailed account of the operations of each party and a statistical statement of results accomplished. Similar abstracts of the office reports are given, and also a statement of the expenditures made under each head of appropriation during the fiscal year. The usual progress sketches, showing graphically the condition of the work in all parts of the country, will be found at the close of the volume.

Detailed estimates for the conduct of the work during the fiscal year 1897, and a letter explaining the same, will be found in their appropriate places.

SPECIAL APPOINTMENTS AND SERVICE.

In accordance with provisions of law, one of the Assistants of the Survey has continued to serve as a member of the Mississippi River Commission, and another, by appointment of the President, is a member of the International Boundary Commission organized for the location of that part of the United States and Mexican boundary line extending from El Paso to the Pacific. During a portion of the fiscal year, however, the officer assigned to this duty was temporarily relieved, and reported to the Superintendent for regular service in the Coast and Geodetic Survey.

At the request of the honorable Secretary of the Navy, two Assistants were temporarily detailed, one for special triangulation in connection with the laying out of a speed trial course in Long Island Sound, and the other for a survey on a large scale of the vicinity of the dry dock at Port Orchard, Puget Sound.

The detail of an officer for the survey of the Virginia oyster beds, at the request of the governor of the State, was continued during a part of the year, or until the completion of the work, and another was detailed for a short time, at the request of the United States Commissioner of Fish and Fisheries, to make further examination of the oyster beds in Mobile Bay and vicinity. Also, an Assistant was detailed, at the request of the governor and legislature of Virginia, to make a special survey of the Fox islands, Chesapeake Bay. The detail of an Assistant for the Massachusetts triangulation and town boundary survey also continued during the greater part of the fiscal year. Notices more in detail of the work of these officers will be found under the heading "Special operations," toward the close of Part I of this report, and under the same heading summaries of the operations of parties engaged on the Alaska-British Columbia boundary surveys will be given.

OFFICE OF STANDARD WEIGHTS AND MEASURES.

The special operations of this office have been carried on during the year, and the usual amount of work has been done for other Departments of the Government, and for States, colleges, surveyors, manufacturers, and others.

The final comparisons of the weights and measures for the States of North and South Dakota have been completed, and the sets were forwarded to their respective destinations in June. The new Rueprecht balance has been mounted on a suitable pier and a careful test of its accuracy was made, with very satisfactory results; but unfortunately the room in which it is mounted is not well adapted for the purpose, being so damp that it is feared the balance will suffer if a more suitable room is not soon provided.

Further comparisons of the "Committee metre" and "Prototype No. 21" have been made, and although the results are very accordant, there is still a small outstanding discrepancy that is not accounted for. The relation between the two standards will be redetermined by another method as soon as opportunity offers.

The densities and masses of the "X" set of gramme weights have been determined, and the results are given in the report of the Assistant in charge of weights and measures. A tabular statement of the work done by the weights and measures office for other branches of the Government, and for outside parties, and of information furnished during the year, accompanies the same report.

ARRANGEMENT OF THIS REPORT.

The contents of Part I, Report for 1895, are arranged in the following order:

Introductory statement, including notice of special appointments and service; Statement relative to the work of the Office of Standard Weights and Measures; Arrangement of this report, and geographical order and classification of localities of field work; General statements of progress in field and office work, including notices of publications of the Survey during the year; Explanation of estimates for the fiscal year 1897, and the estimates themselves in detail; Abstracts of reports from field parties, and of reports of special operations; Abstracts of office annual reports; Notices of the suboffices of Philadelphia and San Francisco; Supplementary tables, viz, No. 1,

Showing the distribution and personnel of field parties of the Survey; No. 2, Giving statistics of field and office work; No. 3, giving list of information furnished during the year in reply to official and personal calls; Office annual reports, viz, No. 1, Report of the Assistant in charge of the Office, accompanied by reports of the various chiefs of divisions; No. 2, Report of the hydrographic inspector; No. 3, Report of the disbursing agent; No. 4, Report of the Assistant in charge of the Office of Standard Weights and Measures; List of maps and progress sketches to illustrate the work, and the maps and sketches themselves at the end of the volume.

Part II contains the Appendixes and their illustrations, the Appendixes being professional and scientific papers relating to methods, discussions, and results of the Survey.

GEOGRAPHICAL CLASSIFICATION OF LOCALITIES OF FIELD WORK.

The geographical classification of localities adopted in 1891 is still continued in this Report, viz:

I. The Eastern Division, including all States east of the Mississippi River.

II. The Middle Division, comprising the States and Territories between the Mississippi River and the Rocky Mountains.

III. The Western Division, embracing the States and Territories between the Rocky Mountains and the Pacific Ocean.

IV. The Division of Alaska, including Alaska and the Aleutian and Pribilof islands.

GENERAL STATEMENT OF PROGRESS.

FIELD WORK.

EASTERN DIVISION.—*States east of the Mississippi River.*—Within the limits or off the coasts of the States east of the Mississippi River the following-named operations were begun, continued, or completed during the fiscal year 1895: Topographic and hydrographic survey of Boston Harbor and vicinity, completed; topographic and hydrographic resurvey of Buzzards Bay, Massachusetts, begun and progress made; hydrographic survey of Nantucket Sound, completed; physical hydrography of the north shore of Nantucket Island, continued; determination of town boundaries in Massachusetts, continued; magnetic observations made at Nantucket, Massachusetts; hydrographic resurveys and special developments on the coast of Massachusetts, including the survey of Salem Harbor; hydrographic examinations in Long Island Sound, completed; hydrographic surveys and examinations in Narragansett Bay and vicinity, completed; topographical survey of the Hudson River and triangulation incident thereto, continued; line of levels from Albany to Dobbs Ferry, completed; additional triangulation on Long Island, at the request of the honorable Secretary of the Navy, for use in laying out a speed-trial course for naval vessels, completed; tidal observations at Newport, completed; topographical resurvey of the south shore of Long Island, continued; tidal observations at Fort Hamilton and Willets Point, New York Harbor, continued; triangulation in southeastern New Jersey, continued; magnetic declination, dip and intensity determinations at Sandy Hook, New Jersey, completed; hydrographic examinations in Chesapeake Bay, completed; hydrographic examination in the vicinity of the Delaware Breakwater, completed; cadastral survey of the Naval Observatory Reservation in the District of Columbia, completed; magnetic declination, dip and intensity determinations at Cape Henry, Virginia, completed; special survey of the Fox islands, Chesapeake Bay, at the request of the governor of Virginia, completed; line of precise levels from Richmond, Va., to Washington, D. C., completed; survey of the natural oyster beds of Virginia, completed; topographic and hydrographic survey of Charleston Harbor and the Cooper and Ashley rivers, completed; magnetic declination, dip and intensity determinations at Charleston, S. C., completed; topographical resurvey of Pensacola Bay and its tributaries, completed; hydrographic resurvey of Pensacola Bay and its tributaries, continued; magnetic declination, dip and intensity determinations at Savannah, Ga., completed; reconnaissance, opening lines, and signal building for the extension of the primary triangulation in Alabama to the Gulf of Mexico, continued; redetermination of water densities in Mobile Bay and vicinity, in connection with the oyster-bed survey made for the United States Commission of Fish and Fisheries, completed; occupation of stations in northeastern Tennessee and southeastern Kentucky for the extension of the triangulation of those States to connect with the primary triangulation to the eastward, continued; relative gravity determinations at Washington, D. C.; Deer Park, Md.; Cleveland and Cincinnati, Ohio; Terre Haute, Ind., and Chicago, Ill., completed.

MIDDLE DIVISION.—*States and Territories between the Mississippi River and the Rocky Mountains.*—Within the limits of the Middle Division the following operations were in progress or completed during the fiscal year:

Telegraphic longitude determinations at New Orleans, La., and Austin, Galveston, Laredo, and El Paso, Tex., and the determination of the magnetic elements at the same points, in progress; determinations of the relative force of gravity by means of half-second pendulums at New Orleans, La., and Austin, Galveston, Laredo, and El Paso, Tex., in progress; triangulation and topography

in Minnesota in the vicinity of the cities of St. Paul and Minneapolis, continued; photographic magnetic record at the Magnetic Observatory near San Antonio, Tex., and the monthly absolute determinations at the same place, completed (the series at this point is not so long as is desirable or as was at first contemplated, but the necessity for redetermining the magnetic elements at many other points in order to correct the magnetic information given on the Coast and Geodetic Survey chart compelled the discontinuance of the observatory in April, as the appropriations for magnetic work were too limited to accomplish both objects); reconnaissance of the Rio Grande from its mouth to El Paso, Tex., completed; precise leveling on the line from the Gulf of Mexico to Kansas City, Mo., continued and completed; determinations of relative gravity at St. Louis, Mo., Kansas City, Mo., Ellsworth, and Wallace, Kans., completed; latitude determinations at Laredo, Galveston, and Austin, Tex., completed; reconnaissance for a scheme of triangulation from El Paso, Tex., to the Gulf of Mexico, completed.

WESTERN DIVISION.—*States and Territories west of the Rocky Mountains.*—Within the limits of the Western Division the following operations were in progress or completed during the fiscal year:

Topographic and hydrographic resurvey of San Francisco Bay and Harbor, in progress; tidal record at Sausalito tidal station, continued; telegraphic determinations of differences of longitude at Needles, Cal., and Santa Fe, N. Mex., completed; latitude determination at Needles, and magnetic determinations at Needles and Santa Fe, completed; determination of the magnetic elements at Lake Tahoe, California, and Carson City, Nev., completed; determination of the magnetic elements at various stations in Oregon and Washington, completed; hydrographic surveys in Washington Sound and Straits of Fuca, continued; triangulation and topography of Washington Sound, continued; hydrographic surveys off the coast from Grays Harbor to Quillayute River, completed; hydrographic examination of the water front and harbor of Tacoma, Wash., completed; gravity determinations at various stations in Colorado, Wyoming, and Utah, completed; laying out of a meridian line at Colorado Springs, completed; continuation of the great scheme of transcontinental triangulation in Colorado.

DIVISION OF ALASKA.—In this division, which includes the coasts of Alaska bordering upon the Pacific Ocean, Bering Sea, and the Arctic Ocean, with the sounds, bays, inlets, and rivers, the following field operations were in progress or completed:

Hydrographic surveys of Chatham Strait from Point Augusta to Point Samuel, the west end of Kenasnow Island and Freshwater Bay, Tenakee Inlet (Siwash Passage), and the north end of Hoods Bay, including Killisnoo Harbor, completed; hydrographic and general surveys in Chatham Strait, Hootznahoo or Kootznahoo Inlet and Peril Strait, in progress; transportation of chronometers between astronomical stations, in connection with the astronomical observations of the Alaska boundary survey parties; tidal observations at Sitka continued and completed. (For the continuation of the Alaska boundary surveys, see under head of "Special operations.")

SPECIAL OPERATIONS.—Under this head are included operations undertaken by special authority of Congress or at the request of other Departments of the Government or of State authorities, and the following were in progress or completed during the fiscal year:

Determination of geographical positions for the establishment of a speed-trial course for naval vessels in Long Island Sound, completed (this was done at the request of the honorable Secretary of the Navy); establishment of the Naval Observatory Circle, radius of 1 000 feet, completed (by order of Congress; joint resolution approved August 1, 1894); special survey of the Fox islands, Chesapeake Bay, completed; surveys for the State of Virginia for the mapping of the natural oyster beds, completed; survey of the oyster beds of Mobile Bay and vicinity, for the United States Commission of Fish and Fisheries, completed; operations of the International Boundary Commission for the relocation and marking of the boundary line between the United States and Mexico, from El Paso to the Pacific Ocean, continued; survey of the oblique boundary line between the States of California and Nevada, continued; Alaska boundary surveys, including the various operations of triangulation, astronomical observations, topography, base measurement, etc., continued in various localities, viz, triangulation and topographic reconnaissance of Chilkat and Taiya inlets; topographic reconnaissance to the northward and eastward of Taiya Inlet and River; topographic reconnaissance to the northward and westward of Chilkat Inlet and River;

topographic reconnaissance of Chilkat and Chilkoot inlets; astronomical determinations at Marys Island, the head of Portland Canal and Port Simpson; triangulation of Portland Canal from its head to Port Simpson; transportation of chronometers between the astronomical station at Seattle, Wash., and the various astronomical stations in Alaska, for the determination of the longitude of the latter; triangulation and base measurements between Marys Island and Port Simpson; astronomical observations at Seattle in connection with the Alaska boundary surveys.

Reference to reports made by the officers in charge of the various parties will be found in the body of the report under the appropriate division headings.

OFFICE WORK.

The annual report of the Assistant in charge of the Office, which is accompanied by the reports of the chiefs of the several divisions of the Office, is published as Office Report No. 1, toward the close of Part I, and presents in concise form a statement of the progress made and the results accomplished during the fiscal year. In Office Report No. 2 is given the annual report of the hydrographic inspector and of the divisions under his charge. Abstracts of these reports follow the abstracts of reports of the field parties. Office Report No. 3 contains the report of the disbursing agent, and a statement of the expenditures of the United States Coast and Geodetic Survey and of the Office of Standard Weights and Measures during the fiscal year. Office Report No. 4 contains the report of the Assistant in charge of the Office of Standard Weights and Measures, and is accompanied by an abstract of the verifications made during the year.

NOTICES TO MARINERS.

The prompt publication of discoveries and developments made in the progress of the operations of the Survey has undoubtedly been of great service to navigation and the interests of commerce. In the Notices to Mariners, published monthly during the year, information is given relative to changes in aids to navigation, new dangers discovered, new life-saving stations established, changes of depths of channels and harbor approaches, and generally to all matters of interest to the mariner. Each notice contains also the titles of new charts or new editions of old charts, and a list of all charts cancelled. During the year, 114 000 copies of Notices to Mariners were printed for free distribution. They are sent to the several chart agencies of the Survey, in the principal ports of the United States, to United States custom-houses, to the branch hydrographic offices of the Navy Department in the various seaports, to United States consulates in foreign ports, and are supplied at these places to all applicants, as also at the offices of the Survey, in Washington, San Francisco, and Philadelphia.

BULLETINS.

Professional papers of the Survey which seem to demand immediate publication are given to the public in abridged form as bulletins and are subsequently published in full as Appendixes to the Annual Report. Four bulletins were published during the year, as follows:

Bulletin No. 31: Legal Units of Electrical Measure in the United States.

Bulletin No. 32: The Constant of Aberration as determined from Observations of Latitude at San Francisco, Cal.

Bulletin No. 33: The Direction and Intensity of the Earth's Magnetic Force at San Francisco, Cal.

Bulletin No. 34: Distribution of the Magnetic Declination in Alaska and adjacent Waters for the Year 1895.

Other publications of the Survey during the year will be found enumerated in the Report of the Chief of the Miscellaneous Division.

EXPLANATION OF ESTIMATES.

The estimates submitted to the Secretary of the Treasury for the fiscal year 1897 were accompanied by the following explanations:

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
Washington, D. C., September 20, 1895.

SIR: I have the honor to transmit herewith the estimates of appropriations required for the service of the United States Coast and Geodetic Survey and Office of Construction of Standard Weights and Measures for the fiscal year ending June 30, 1897.

The amount asked for "field expenses" is $169 000, as against $110 500 appropriated for 1895–96, an increase of $58 500. An increase of appropriation under this head is necessary for the rapid and economical prosecution of surveys urgently demanded in the interest of commerce along our coasts, and for the advancement of other important field operations of the Survey. With a less amount the parties of the Survey can not be employed to full advantage, as it is possible for them to remain in the field only for a portion of the available working months, while the expense of fitting out and transporting parties to the field and return is the same for a short as for a long season. The vessels engaged in the hydrographic portions of the work should be employed almost continuously to keep pace with the demand for surveys and examinations in various important localities, but this will be impracticable with the amount appropriated for the current year.

The original survey of the Chesapeake Bay was made many years ago, and since then the erosive action of the tides has washed away entire points, eaten into the shore and deposited the material into the channel, so that neither the shore lines nor depths of water shown upon the charts of this bay agree with the true condition of affairs at the present time. These charts are therefore defective and misleading, and hence the necessity of an entire resurvey of Chesapeake Bay.

An item of $5 000 has been inserted for continuing the boundary survey between Alaska and British Columbia and the Northwest Territory.

An appropriation of $50 000 is also asked to commence the construction of a new vessel for work on the coast of Alaska and among the Aleutian Islands. A suitable vessel for this work is urgently needed to replace the Coast and Geodetic Survey steamer *Hassler*, which has recently been condemned as unfit for further service.

The item for repairs of vessels is $25 000 as against $38 000 for the current year, a decrease of $13 000.

The items of the estimate for pay of field force are identical with those of the appropriation for 1895–96, except that an addition of $1 500 is asked for the pay of temporary aids. A slight increase in the number of those employed under this designation will be advantageous in enabling the Survey to secure the service of qualified young men who are willing to remain permanently in the service with the hope of advancement to a higher grade.

In the appropriation for pay of office force, an addition of $200 per annum to the pay of one of the carpenters is asked. The master carpenter originally received $1 600 per annum which the last appropriation reduced to $1 200. The present incumbent is a skillful joiner, as well as carpenter, and as the duties of this position deserve a higher compensation than those now paid, an increase from $1 200 to $1 400 has been recommended.

It is proposed to increase the force of copper plate engravers by the addition of one at $1 400 and one at $1 000, and to increase the appropriation for extra engravers by the amount of $100.

The paragraph under the head of "office expenses," containing an item for extra engraving, is reduced, however, by the amount of $2 500, as the proposed increase of force will lessen the amount of extra engraving to be done under contract.

Under the paragraph for "Electrotypers and photographers, plate printers and their helpers," etc., it is proposed to increase the pay of four employees from $1 000 to $1 100 each, and the pay of four employees from $700 to $750 each. The pay of these employees has been reduced by former appropriations below the standard paid for the same character of work elsewhere, and the rates herein recommended are not yet up to the full standard rates.

In the force of computers it is recommended that one be increased from $1 200 to $1 600, and one from $1 400 to $1 600, in order that the rates of pay may conform more nearly to the value of the services performed by individuals.

It is believed that these increases will add considerably to the efficiency of the office force.

The items of the estimates for Office of Construction of Standard Weights and Measures are the same as those of the appropriation for the current year, except that an increase of $300 is asked in the salary of the adjuster, whose services are well worth the increased amount recommended.

Respecfully, yours,

W. W. DUFFIELD,
Superintendent.

The SECRETARY OF THE TREASURY,
Washington, D. C.

ESTIMATES FOR THE FISCAL YEAR ENDING JUNE 30, 1897.

For every expenditure requisite for and incident to the survey of the Atlantic, Gulf, and Pacific coasts of the United States and the coast of the Territory of Alaska, including the survey of rivers to the head of tide water or ship navigation; deep-sea soundings, temperature, and current observations along the coast and throughout the Gulf Stream and Japan Stream flowing off the said coasts; tidal observations; the necessary resurveys; the preparation of the Coast Pilot; continuing researches, and other work relating to terrestrial magnetism and the magnetic maps of the United States and adjacent waters, and the tables of magnetic declination, dip and intensity usually accompanying them; and including compensation not otherwise appropriated for, of persons employed in the field work, in conformity with the regulations for the Government of the Coast and Geodetic Survey adopted by the Secretary of the Treasury; for special examinations that may be required by the Light-House Board or other proper authority, and including traveling expenses of officers and men of the Navy on duty; for commutation to officers of the field force while on field duty, at a rate to be fixed by the Secretary of the Treasury, not exceeding $2·50 per day each; outfit, equipment, and care of vessels used in the Survey, and also the repairs and maintenance of the complement of vessels; to be expended in accordance with the regulations relating to the Coast and Geodetic Survey from time to time prescribed by the Secretary of the Treasury and under the following heads: *Provided*, That no advance of money to chiefs of field parties under this appropriation shall be made unless to a commissioned officer or to a civilian officer who shall give bond in such sum as the Secretary of the Treasury may direct:

FOR FIELD EXPENSES:

For survey of unfinished portions of the Atlantic Coast from Maine to Florida, including Portsmouth Harbor and Piscataqua River, Hudson River to Troy, and for the necessary resurveys including the coast from Lynn to Cape Ann, the shores of Marthas Vineyard, and Nantucket Sound, approaches to New Bedford, Buzzards Bay, Chesapeake Bay, and tributaries and Savannah River Bar	$30 000
To continue the primary triangulation from the vicinity of Montgomery toward Mobile, and for triangulation, topography, and hydrography of unfinished portions of the Gulf Coast, including Lake Pontchartrain and Sabine Lake, and for the necessary resurveys	10 000
For offshore soundings along the Atlantic and Gulf coasts, and current and temperature observations in the Gulf Stream	8 000
For triangulation, topography, and hydrography of the coasts of California, Oregon, and Washington and for necessary resurveys, San Francisco Harbor, triangulation, topography, and hydrography.	25 000

FOR FIELD EXPENSES—Continued.	
For continuing explorations in the waters of Alaska and making hydrographic surveys in the same, including survey of the Aleutian Islands and examination of the mouth of Yukon River, and for the establishment of latitude, longitude, and magnetic stations	$20 000
For continuing the boundary survey between Alaska and British Columbia and the Northwest Territory	5 000
For continuing the researches in physical hydrography relating to harbors and bars, including computations and plattings, and for tidal and current observations on the Atlantic, Gulf, and Pacific coasts	10 000
For examination of reported dangers on the Atlantic, Gulf, and Pacific coasts, and to continue the compilation of the Coast Pilot and to make special hydrographic examinations, and including the employment of such pilots and nautical experts in the field and office as may be necessary for the same	5 000
To continue magnetic observations in all parts of the United States	2 500
For continuing the line of exact levels between the Atlantic, Pacific, and Gulf coasts	2 500
For furnishing points to State surveys, to be applied as far as practicable in States where points have not been furnished; and for surveying and distinctly marking with permanent monuments that portion of the eastern boundary of the State of California commencing at and running southeastward from the intersection of the thirty-ninth degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, and for the primary triangulation along the Rio Grande	20 000
For determinations of geographical positions and to continue gravity observations	3 500
For continuing the transcontinental geodetic work on the line between the Atlantic and Pacific oceans, and for beginning the measurement of a meridian arc in about longitude 98° west of Greenwich	18 000
For traveling expenses of officers and men of the Navy on duty, and for any special surveys that may be required by the Light-House Board or other proper authority, and contingent expenses incident thereto	3 500
For objects not hereinbefore named that may be deemed urgent, including the actual necessary expenses of officers of the field force temporarily ordered to the office at Washington for consultation with the Superintendent, to be paid as directed by the Superintendent, in accordance with the Treasury regulations	6 000
[For contribution to the International Geodetic Association for the Measurement of the Earth, $550, or so much thereof as may be necessary, to be expended through the office of the American Embassy at Berlin: and for expenses of the attendance of the American delegate to the general conference of said association, $550, or so much thereof as may be necessary: *Provided,* That such contribution and expenses of attendance shall be payable out of the item "for objects not named;" and 20 per cent of the foregoing amounts shall be available interchangeably for expenditure on the objects named.]	
In all, for field expenses	169 000
FOR REPAIRS AND MAINTENANCE OF VESSELS:	
For repairs and maintenance of the complement of vessels used in the Coast and Geodetic Survey, including the traveling expenses of the person inspecting the repairs	25 000
FOR A NEW STEAMER FOR USE IN ALASKA:	
For constructing a steamer under the direction of the Secretary of the Treasury for service in Alaska and the Aleutian Islands	50 000
[And the Secretary of the Treasury is hereby authorized to contract for building said vessel at a cost not to exceed $125 000.]	
SALARIES COAST AND GEODETIC SURVEY:	
For Superintendent	6 000
For pay of assistants, to be employed either in the field or office, as the Superintendent may direct:	
For two assistants, at $4 000 each	8 000
For one assistant	3 200
For four assistants, at $3 000 each	12 000
For four assistants, at $2 500 each	10 000
For seven assistants, at $2 200 each	15 400
For seven assistants, at $2 000 each	14 000
For three assistants, at $1 800 each	5 400
For three assistants, at $1 600 each	4 800
For three assistants, at $1 400 each	4 200
For four assistants, at $1 200 each	4 800
For aids temporarily employed, at a salary not greater than $900 per annum each	5 100
In all	92 900

PAY OF OFFICE FORCE:

For one disbursing agent	$2 200
For one general office assistant	1 800
For one chief of division of library and archives	1 800
For one clerk to Superintendent	1 200
For one clerk to the assistant in charge of office and topography	1 000
For clerical force, namely:	
For two, at $1 650 each	3 300
For three, at $1 400 each	4 200
For five, at $1 200 each	6 000
For three, at $1 000 each	3 000
For chart correctors, buoy colorists, stenographers, writers, typewriters, and copyists, namely:	
For two, at $1 200 each	2 400
For three, at $900 each	2 700
For one	800
For seven, at $720 each	5 040
For one	600
For topographic and hydrographic draftsmen, namely:	
For one	2 400
For one	2 200
For two, at $2 000 each	4 000
For three, at $1 800 each	5 400
For two, at $1 400 each	2 800
For one	1 200
For two, at $1 000 each	2 000
For two, at $900 each	1 800
For astronomical, geodetic, tidal, and miscellaneous computers, namely:	
For two, at $2 000 each	4 000
For five, at $1 600 each	8 000
For one	1 400
For one	1 200
For two, at $1 000 each	2 000
For copperplate engravers, namely:	
For two, at $2 000 each	4 000
For two, at $1 800 each	3 600
For two, at $1 600 each	3 200
For one	1 400
For two, at $1 200 each	2 400
For two, at $1 000 each	2 000
For additional engravers, at not to exceed $900 per annum each	4 100
For electrotypers and photographers, plate printers and their helpers, instrument makers, carpenters, engineer, and other skilled laborers, namely:	
For two, at $1 800 each	3 600
For one	1 600
For one	1 400
For one	1 200
For four, at $1 100 each	4 400
For six, at $1 000 each	6 000
For two, at $900 each	1 800
For four, at $750 each	3 000
For three, at $700 each	2 100
For watchmen, firemen, messengers and laborers, packers and folders, and miscellaneous work, namely:	
For three, at $880 each	2 640
For six, at $820 each	4 920
For two, at $700 each	1 400
For three, at $640 each	1 920
For four, at $630 each	2 520
For four, at $550 each	2 200
For two, at $365 each	730
In all	136 570

OFFICE EXPENSES:	
For the purchase of new instruments, for materials and supplies required in the instrument shop, carpenter shop, and drawing division, and for books, maps, charts, and subscriptions	$8 000
For copperplates, chart paper, printer's ink, copper, zinc, and chemicals for electrotyping and photographing; engraving, printing, photographing, and electrotyping supplies; for extra engraving and drawing, and for photolithographing charts and printing from stone and copper for immediate use	15 500
For stationery for the office and field parties, transportation of instruments and supplies, when not charged to party expenses, office wagon and horses, fuel, gas, telegrams, ice, and washing	6 000
For miscellaneous expenses, contingencies of all kinds, office furniture, repairs, and extra labor, and for traveling expenses of assistants and others employed in the office sent on special duty in the service of the office	4 500
	34 000
PUBLISHING OBSERVATIONS:	
For the discussion and publication of observations	1 000
[That no part of the money herein appropriated for the Coast and Geodetic Survey shall be available for allowance to civilians or other officers for subsistence while on duty at Washington (except as hereinbefore provided for officers of the field force ordered to Washington for short periods for consultation with the Superintendent), or to officers of the Navy attached to the Survey except as now provided by law.]	
PRINTING AND BINDING, COAST AND GEODETIC SURVEY:	
For printing and lithographing, photolithographing, photoengraving, and all forms of illustration done by the Public Printer, on requisition by the Treasury Department, for the Coast and Geodetic Survey, namely:	
Tide tables, coast pilots, appendixes to the Superintendent's annual reports, published separately; notices to mariners, circulars, blank books, blank forms, and miscellaneous printing, including the cost of all binding and covering; the necessary stock and materials and binding for the library and archives	20 935
NOTE.—No engraving is done by the Public Printer for the Coast and Geodetic Survey.	
Total Coast and Geodetic Survey, exclusive of printing and binding	508 470
OFFICE OF CONSTRUCTION OF STANDARD WEIGHTS AND MEASURES:	
Salaries, Office of Standard Weights and Measures—	
For construction and verification of standard weights and measures, including metric standards, for the custom-houses, other offices of the United States and for the several States, and mural standards of length in Washington, D. C.—	
For 1 adjuster	1 800
For 1 mechanician	1 250
For 1 assistant messenger and 1 watchman	1 440
In all	4 490
Contingent expenses, Office of Standard Weights and Measures—	
For purchase of materials and apparatus, and incidental expenses	500
For expenses of the attendance of the American member of the International Commitee on Weights and Measures at the general conference provided for in the convention signed May 20, 1875, the sum of $475, or so much thereof as may be necessary	475
Total, contingent expenses, Office of Standard Weights and Measures	975

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

EASTERN DIVISION.

STATES EAST OF THE MISSISSIPPI RIVER.

1. Maine.
2. New Hampshire.
3. Vermont.
4. Massachusetts.
5. Rhode Island.
6. Connecticut.
7. New York.
8. New Jersey.
9. Pennsylvania.
10. Delaware.
11. Maryland.
12. District of Columbia.
13. Virginia.
14. North Carolina.
15. South Carolina.
16. Georgia.
17. Florida.
18. Alabama.
19. Mississippi.
20. Michigan.
21. Wisconsin.
22. Ohio.
23. Indiana.
24. Illinois.
25. West Virginia.
26. Kentucky.
27. Tennessee.

Progress Sketches, Nos. 1 to 14, inclusive, show the localities of field work in the Eastern Division. A list of Progress Sketches will be found at the close of this volume.

Continuation of the topographic resurvey of Boston Harbor and vicinity.—As stated in the report of the previous fiscal year it had been decided to expedite the resurvey of Boston Harbor and vicinity by putting in the field a force sufficient to complete the remaining part of the work in a single season, and five topographical parties were therefore organized in June, 1894, and a sixth in the following August. The parties were under the charge respectively of Assistant Herbert G. Ogden, Otto H. Tittmann, R. Meade Bache, Charles H. Boyd, Washington I. Vinal, and Dallas B. Wainwright. Assistant Henry L. Whiting was charged with the general supervision of the whole, and the various chiefs of parties were directed to confer freely with him in regard to sheet limits, methods of delineation and generalization, and other details, with a view to securing uniformity in these matters in all parts of the finished map. The work was laid out on seven projections, on a scale of 1–10 000, numbered consecutively, and embracing the whole shore line, with bays, islands, indentations, etc., from the vicinity of Cedar Point to the northern limit of Nahant Bay, the width of the solid topography averaging about 3 miles, but varying, according to local requirements, from 2 to 5 miles.

To avoid the expense of making a complete survey of the streets of Boston and adjacent towns and villages, access was obtained, through the courtesy of the local officials, to the city engineer's maps, and these were reduced to the scale of the survey and platted in their proper places on the topographical sheets, a sufficient number of points of control being first determined by the plane table to make their accurate platting and orientation practicable. The greater part of this compilation was assigned to Assistant Wainwright, but some was also done by the other parties. The limits of the work on the seven field sheets, as originally laid out, may be given approximately as follows:

Sheet No. 1 extends from a point 1 mile above Cedar Point, northward to Minots Ledge Light, and westward to a small creek about 2 miles east of Hingham, embracing an area of topography of about 10 square miles.

Sheet No. 2 extends from the eastern limits of sheet No. 1, as above given, to Weymouth Fore River, and includes about the same area of topography.

Sheet No. 3 extends from Weymouth Fore River to Neponset River, embracing an area of about 8 square miles.

Sheet No. 4 extends from the Neponset River to Charles River, including Roxbury, Dorchester, etc., but excluding the city of Boston, an area of about 13 square miles.

Sheet No. 5 extends from the northern limits of sheet No. 4 to an irregular line along the northern side of the city, and includes Boston, South Boston, East Boston, Cambridge, East Cambridge, and Chelsea, and several islands of the inner harbor, an area of about 12 square miles.

Sheet No. 6 extends from the irregular line along the north side of Cambridge, Boston, and Chelsea, northward to Medford and Center Village, and extends to the shores of Broad Sound, embracing an area of 14 square miles of topography.

Sheet No. 7 extends from Chelsea Creek to the northern and eastern limits of Nahant Bay, including Nahant, Lynn Harbor, and a portion of the city of Lynn, approximate area of topography 5 square miles. These limits were, in some cases, somewhat modified as the season advanced, according to the rates of progress made by the various parties, with a view to insuring the completion of the whole work before winter. These modifications could be readily made owing to the fact that the projections necessarily overlapped each other to some extent.

The different sections of the work will be taken up seriatim, and the statistics of each party will be given separately.

Mr. Whiting continued in general charge of the resurvey until the close of the season, and from time to time inspected the work of the parties in the field. He was absent, however, for short periods on special business connected with his duties as chairman of the Massachusetts Topographical and Town Boundary Commission, and member of the Mississippi River Commission.

Topographic resurvey of Boston Harbor.—Cohasset and Quincy sheets.—Projections Nos. 1 and 3, embracing the limits already given, and designed as the Cohasset and Quincy sheets, respectively, were assigned to the party under the direction of Assistant Herbert G. Ogden. The party was organized at Cohasset on June 13, and field operations were at once commenced. The first sheet was completed by September 9 and the other by November 19. Mr. Ogden remarks that these sheets contain an unusual amount of detail of natural features, as the country is much broken, but without any considerable elevations except Scituate and Turkey hills on the Cohasset sheet, and Forbes Hill on the Quincy sheet. At Cohasset there are large tracts of densely wooded land, involving intricate contours which took much time to delineate, although no attempt was made to secure the same degree of accuracy as was required in the open country. At Quincy a large area is subdivided into town sites, but Mr. Ogden was able to obtain from Mr. Whitman, a civil engineer of that place, a complete plan of the subdivisions, and this, reduced to the scale of the topographic sheets and platted thereon, saved a large amount of labor and time in the field. The weather throughout the season was very favorable until about the 1st of November, and the few remaining fair days then necessary to complete the work were not obtained until the 19th. Mr. Ogden concludes from this and former experience that, except in cases of emergency, parties in this section of the country should not attempt to keep in the field after November 1.

The statistics of the work of the season are given as follows:

Area surveyed, in square statute miles	$17\frac{1}{2}$
Coast line surveyed, in statute miles	$11\frac{1}{2}$
Shore line of rivers surveyed, in statute miles	$23\frac{1}{2}$
Shore line of creeks surveyed, in statute miles	$29\frac{3}{4}$
Shore line of ponds surveyed, in statute miles	$5\frac{1}{2}$
Roads surveyed, in statute miles	$118\frac{1}{3}$
Marsh line surveyed, in statute miles	$35\frac{1}{2}$
Number of finished topographic sheets	2

After disbanding the party Assistant Ogden, accompanied by his recorder, in accordance with special instructions, proceeded, on November 22, to Greenport, Long Island, for the purpose of executing some supplemental triangulation to determine points for the establishment of a speed trial course on Long Island Sound. On the completion of this work, which will be noticed in detail under the proper geographical heading, he proceeded to Washington, reporting at the Coast and Geodetic Survey Office December 18. From that date to the close of the fiscal year Mr. Ogden was occupied in inking his topographical sheets, computing his triangulation, and completing and computing the records of his previous season's work in Alaska.

Topographical resurvey of Boston Harbor.—Lynn sheet.—The party under the charge of Assistant O. H. Tittmann was organized just before the close of the last fiscal year, and field work was commenced on June 15, 1894, as mentioned in the report for that year. The section assigned to this party is covered by Projection No. 7, and extends from the eastern limit of Assistant Iardella's work, about 1 mile west of the Point of Pines, to Phillips Beach, and includes a relatively narrow strip of topography. A portion of the city of Lynn falls within the limits of this topographic sheet, but only the streets running to the water's edge, or near it, were determined by actual survey. The plat of the streets farther back was derived from Byer's map of 1876, with such corrections as were indicated by Mr. Charles W. Gay, the city engineer of Lynn. From Mr. Gay's records some heights were also obtained, which facilitated the tracing of the contour lines in the city.

Mr. Tittmann reports that the principal changes that have taken place in this section since the date of the earlier survey are to be found in the artificial features, the most important of these being in the dock and wharf lines in Lynn Harbor; in the railway crossings of Chelsea Creek and Saugus River; and those caused by the erection of many new and prominent buildings. Many of the old triangulation points having disappeared, Mr. Tittmann obtained from the Massachusetts State Topographical Survey, through Assistant H. L. Whiting, the geographical positions of a number of their stations, and determined trigonometrically such additional points as were necessary.

Mr. Tittmann, in accordance with the Superintendent's instructions, conferred freely with Assistant Whiting in regard to topographical limits and methods of delineation, and by the latter's direction the contour lines throughout the work were referred to mean sea level instead of to mean high water, as heretofore, this being also in conformity with the recommendations of the Topographic Conference held at the Coast and Geodetic Survey Office in 1892.

The season's work closed August 25, the sheet assigned to the party being completed by that date, and Mr. Tittmann disbanded his party and returned to Washington, resuming charge there of the Office of Standard Weights and Measures.

The statistics of the season's work are as follows:

Shore line surveyed, in statute miles	25
Railroads surveyed, in statute miles	8
Streets and roads surveyed, in statute miles	38
Area surveyed, in square statute miles	5¼

The report of the chief of the party is accompanied by a sketch showing the area of topography executed and the positions of the new trigonometric points determined.

Topographic resurvey of Boston Harbor.—Hingham sheet.—In the topographic resurvey of Boston Harbor, the area covered by projection No. 2, the limits of which have already been given, was assigned to the party under the direction of Assistant R. M. Bache. This projection, which has for convenience been designated the Hingham sheet, includes in its area the towns of Weymouth, North Weymouth, East Weymouth, and Hingham.

Mr. Bache reached the working ground June 26, organized his party, and began the erection of signals on the 28th. The necessary preliminary triangulation was executed by July 10, and the topographical work proper was inaugurated July 11 and continued until November 1, when the sheet was completed.

Mr. Bache reports that this topography is of a more intricate character than any he has ever seen within a like area, even in the same region. With the exception of a few great hills, the country is composed of a jumble of accidents of surface, varying from 50 to 80 feet in height complicated by wooded swamps at various elevations, and covered with numerous highways and private roads. The towns of Weymouth, North Weymouth, East Weymouth, and Hingham, with their connecting roads interspersed with houses, practically form one continuous village occupying an area of nearly 8 square miles.

On the completion of the season's work the party was disbanded and Assistant Bache returned to Philadelphia, Pa., and resumed charge of the Coast and Geodetic Survey suboffice.

The statistics of the field work are given as follows:

Number of signals erected	3
Number of geographical positions determined, trigonometrically	2
Area of topography surveyed, in square miles	10¼
River shore line surveyed, in square miles	12¼
Creek and pond shore line surveyed, in statute miles	8½
Length of roads and streets surveyed, in statute miles	54½
Length of railroad surveyed, in statute miles	8
Number of topographical sheets completed	1

Topographical resurvey of Boston Harbor.—Roxbury sheet.—Projection No. 4, extending from the Neponset River to Charles River, was assigned to Assistant Charles H. Boyd, who organized a party and began work on the southern part of the sheet on June 15. The area covered by this sheet, besides containing a large variety of natural topographical details, is thickly dotted with suburban villages and residences, and the dense foliage of shade and fruit trees and ornamental shrubbery, by restricting the view, interfered considerably with the execution of the field work. Notwithstanding these difficulties, however, fair progress was made until August 26, when Assistant Boyd, in accordance with instructions, disbanded his party and turned over the instruments and unfinished sheet to Assistant D. B. Wainwright, who was about to begin work on the adjoining projection, No. 5.

The statistics of the work to that date are as follows:

Area surveyed, in square statute miles	4
Shore line surveyed, in statute miles	17½

Topographical resurvey of Boston Harbor.—Boston sheet.—Projection No. 5, embracing the city of Boston north of Massachusetts avenue, parts of Somerville, Cambridge, Brookline, etc., was assigned to Assistant D. B. Wainwright, and subsequently the unfinished part of projection No. 4 was added in consequence of the discontinuance of Assistant Boyd's party, as already mentioned. Mr. Wainwright organized his party and began operations on the Boston sheet in the latter part of August, first determining with the plane table a large number of objects, such as church spires, towers, etc., to be used as signals on the further prosecution of the work. The surroundings of the cities were completely surveyed with the plane table, as were also the wharf lines, water fronts, and such streets and avenues as furnished the best means of controlling the platting of the compilations and reductions from the city maps. The bulk of the cities of Boston, Cambridge, Somerville, and Brookline were thus compiled and reduced and platted on the topographical sheets, thus saving the Survey great expense, and Mr. Wainwright acknowledges the courtesy of the city engineer, city surveyor, and chief engineer of the board of survey, of Boston; the city engineers of Cambridge, Somerville, and Brighton, and the several members of the State Topographical Survey, in furnishing much valuable data and giving access to their maps. To Mr. Hodgden, the chief engineer of the board of harbor commissioners, he was especially indebted for placing at his disposal a comfortable drafting room in the Commonwealth Building.

Work was continued until December 21, when, owing to the lateness of the season and continued inclement weather, the party was disbanded and Assistant Wainwright returned to Washington, where he was engaged upon his office work until April 1. The resumption and completion of the work in the spring of 1895 will be treated in another paragraph.

The statistics of the season's work are as follows:

Area surveyed and compiled, in square statute miles	19
Length of wharf and river line surveyed, in statute miles	89
Number of topographic sheets worked on	2

Topographic resurvey of Boston Harbor.—Chelsea sheet.—Projection No. 6, with limits modified to include Chelsea, and including also the corporate limits of Everett and Revere and portions of the cities of Malden, Medford, and Somerville, was assigned to Assistant Washington I. Vinal, who organized his party and began field operations on June 13, 1894.

Work was continued without intermission until November 9, when the sheet being completed, the party was disbanded and Assistant Vinal returned to Washington and took up the inking and other office work incident to his field labors.

Mr. Vinal, in his report, acknowledges the valuable assistance, in the way of bench heights, tracings, etc., which was given him by the engineers of the cities that came within the limits of his survey, as well as by the office assistants of the Massachusetts Town Boundary Survey, and states that owing to the rapid growth of the suburban towns and cities, the recent adoption of a comprehensive sewage system, the opening and grading of new streets, and the reclaiming of extensive tracts of marsh lands, it was found necessary to go over the entire area carefully with the plane table to note artificial changes of the surface and deviation from original plans.

He gives a full description of the country covered by his sheet, and enumerates the works of improvement now in progress.

The work of the season is platted on one topographical sheet, scale 1–10 000, and the following is a tabular statement of the results obtained:

Area surveyed, in square statute miles	14
Length of shore line of river, including wharves, in statute miles	24
Length of shore line of creeks, ponds, etc	33
Length of roads, including streets and railroads, in statute miles	160
Topographic sheets finished, scale 1–10 000	1

Resumption and completion of the resurvey of Boston Harbor in the spring of 1895.—On April 1, Assistant D. B. Wainwright reorganized his party for the completion of the work on projections Nos. 4 and 5, including the city of Boston and surrounding towns, and continued in the field until near the close of the fiscal year, when the work was finished. During the latter part of June a portion of the party was sent to New Bedford to recover stations, erect signals, and make other preparations for the survey in that vicinity, and the remainder of the party followed on the close of the Boston work.

In his final report on the Boston resurvey, Mr. Wainwright gives an interesting historical account of the laying out of the city of Boston at the time of its first settlement, and the great topographical changes that have since taken place, especially since the date of the last survey, about forty years ago. These changes apply to the natural as well as the artificial features, many hills having entirely disappeared, while others have been much reduced in height, the material having been used in filling up coves and shallows, and producing the more regular outline of water front that exists to-day, and extensive areas of marsh land having been reclaimed and closely built upon.

The statistics of the work from April 1 until the close of the fiscal year are as follows:

Area surveyed and compiled, in square statute miles	9
Length of river shore line surveyed, in statute miles	12
Number of topographical sheets completed	2

Hydrographic resurveys near Boston, Mass.—By the Superintendent's instructions, dated June 29, Lieut. Robert G. Peck, U. S. N., Assistant, Coast and Geodetic Survey, commanding the steamer *A. D. Bache*, was directed to conduct hydrographic surveys on the coast of Massachusetts. Work was begun on July 16 and closed November 12. Of the four months occupied by this work about two weeks were spent in special hydrographic developments in that portion of Boston Bay extending from Cohasset to Scituate and in the waters of Broad Sound. Several discoveries of sunken rocks were made, and concerning these special reports were at once addressed to the office.

Between August 22 and September 20, a hydrographic resurvey of Lynn Harbor, Saugus River, and Chelsea Creek was made, and then the resurvey of the waters extending from Nahant to Cat Island, including the harbor of Marblehead, was taken up and prosecuted until November 6. The general soundings in this area were completed, but special developments remain to be made during a subsequent season.

A special examination, called for by supplemental instructions dated July 5, was made of Tinkers Ledge and of other shoal water to the eastward of Tinkers Island.

Leaving Marblehead on November 7, the *Bache* made a special examination of seven shoal spots in the approaches to Boston Harbor, which had been noted in the survey of 1892, and which had been afterwards searched for unsuccessfully.

Field work closed November 12.

The officers of the ship were Lieut. Robert G. Peck, U. S. N., commanding; Lieut. W. S. Benson; Ensigns G. W. Kline, C. M. McCormick, and J. W. Oman; Passed Asst. Surg. G. H. Barber; Asst. Engineer A. McAllister. Pay Yeoman J. L. Dunn served as draftsman, and Thomas S. Martin and William H. De Luce as recorders.

The statistics of the season's work are given as follows:

Area sounded, in square geographic miles	41
Number of miles run while sounding	981
Number of angles measured	17 179
Number of soundings recorded	63 461
Number of tidal stations established	8

Hydrographic examinations of reported dangers in Buzzards Bay, Massachusetts.—After completing the hydrographic examination in the vicinity of York Spit, Chesapeake Bay, in July, 1894, the steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., proceeded to Buzzards Bay and made special examinations of reported dangers in that locality. A number of sunken rocks were found in the entrance to Catamount Harbor, off Monument Beach, and off Mishaum. The Ribbon Reef was also newly developed.

On the completion of this work Lieutenant Garrett proceeded with the vessel to Narragansett Bay for the purpose of making further special hydrographic examinations.

The statistics of the Buzzards Bay hydrography are as follows:

Number of angles measured	218
Number of soundings taken	537
Number of miles of sounding lines run	13

Topographic resurvey of the shores of Buzzards Bay, Massachusetts.—A resurvey of Buzzard Bay being urgently needed, on account of the numerous changes reported since the last survey, completed fifty years ago, four topographical parties have been assigned to duty in this region, and it is hoped and expected that the work will be completed this season. Owing to the lack of funds the parties were not able to take the field before the latter part of June, so that the result of the resurvey can not be given in this report. The parties are under the charge, respectively, of Assistants W. I. Vinal, Stehman Forney, D. B. Wainwright, and J. A. Flemer.

Hydrographic resurvey of New Bedford Harbor and approaches.—This being a part of the contemplated resurvey of Buzzards Bay, and being of the first importance, Lieut. G. C. Hanus, commanding the schooner *Eagre*, was directed to begin work in May, or as soon as the repairs of his vessel were completed. There being a sufficient number of well-determined points available at this locality from which others could be determined, the hydrography could be executed in advance of the topography. The hydrographic resurvey of the whole bay will follow in order as soon as the topographic parties can complete the shore line and furnish the requisite geographical positions.

The naval officers composing the party of Lieutenant Hanus are as follows: Lieut. C. S. Ripley, Ensign W. A. Edgar, and Pay Yoeman William B. Proctor.

The statistics of the work to June 30 are as follows:

Number of miles (geographical) of sounding lines	341¼
Number of angles measured	3 308
Number of soundings taken	22 985

Hydrographic resurveys and special developments on the coast of Massachusetts.—Lieut. W. F. Low, U. S. N., Assistant Coast and Geodetic Survey, in command of the schooner *Eagre*, was engaged on July 25 in verifying the position of rocks and shoals, and running lines and soundings for the development of special features on hydrographic sheets 2167, 2161, 2163, and 2146, Boston Harbor and approaches.

On July 27 the survey of Salem Harbor was commenced and carried on until October 9, when the *Eagre* was moved to Gloucester for the survey of that harbor. This was carried on until October 23, after which work was resumed on the Salem sheet and prosecuted up to December 8, when it was finished.

The following officers were attached to the *Eagre:* Lieut. W. F. Low, U. S. N., commanding; Lieut. C. S. Ripley, U. S. N.; Ensigns L. H. Chandler and W. A. Edgar, U. S. N.; Pay Yeoman William B. Proctor; Ships Writer James Proctor.

Statistics from June 30 to December 8 are as follows:

Number of geographical miles run while sounding	820
Number of angles measured	13 086
Number of soundings recorded	63 972
Number of tidal stations established	3
Hydrographic sheets finished, scale 1-10 000	1

Physical hydrography.—North shore of Nantucket Island, Massachusetts.—At the beginning of the fiscal year, the party of Assistant H. L. Marindin was already in the field in pursuance of instructions from the Superintendent, dated May 17. The camp was first located at Trotts Hill, about 3 miles west of the town of Nantucket, and active field operations were begun on June 7. Mr. M. V. Safford, who had considerable previous experience in this class of work, was assigned to the party as additional observer, while Messrs. B. H. Griswold and H. T. Marshall served as recorders, and Mr. Fred McElroy as tidal observer. A crew of men to row the boat and assist in the topographic and leveling work completed the party organization.

The main object of the expedition was to secure accurate data for the construction of a base map for comparison with future surveys, in order to determine the movements of the coast line and the laws and forces governing them, but the survey also serves the immediate purpose of correcting and supplementing the inshore hydrography of the published charts.

The survey of the southern shore of the island was completed in 1891, but it was then decided that the survey should be extended to include the remaining shores, and those of Marthas Vineyard also, in order to obtain a more comprehensive view of the effect of current and tidal action in the locality.

In detail the work consists of laying out cross sections normal to the shore at regular distances, and in sounding accurately along these lines until a depth of from 30 to 36 feet is reached. The cross sections are then continued inland for a short distance by lines of levels referred to the plane of mean sea level, as derived from a permanent tidal station in the vicinity. In this instance the tidal station was located at Swain's Wharf, in Nantucket Harbor, and continuous observations were made there from June to September, but as the work progressed, temporary staffs were also erected at various points, and connected with the main station by simultaneous tidal readings. Permanent bench marks were established at various points, and connected by spirit leveling with the cross-section lines and with the plane of mean sea level, as deduced from the tidal observations. By means of the data furnished by Assistant Marindin it will be possible at any time in the future to reproduce any or all of the cross-section lines established by him, and a comparison of the elevations and depths then found upon them, with those now existing, will show the nature and extent of the natural changes accomplished or in progress. Any extension or erosion of the coast line, or its gradual elevation or subsidence, will thus be indicated, and much light thrown upon important physical problems. The ordinary hydrographic surveys for chart publication in the interests of navigation will not suffice for such purposes, as in them the relations between land and water areas are not determined, and moreover, the soundings taken near shore are not sufficiently numerous, nor measured and located with sufficient accuracy.

The mean range of the tide at Swain's Wharf, as derived from 112 readings of high and low water, is 3·07 feet, a result differing by only a few hundredths of a foot from that obtained from a long series of observations at the same point in 1854.

The subsidiary tidal stations on Nantucket Island were located at Trotts Hill, Eel Point, Maddequet Harbor, and Smiths Point, but the observations at Trotts Hill and Maddequet Harbor only were used in the reduction of soundings. The observations at Smiths Point indicate an interference both as to time and range of tide, the interference being due to the opening in the south beach. How far the effect reaches into the sound was not ascertained.

By September 6 the circuit of the Island was completed by connecting with the work of 1891 at Smiths Point, and the camp was then transferred to Marthas Vineyard and pitched between Edgartown and Cottage City. From this point the north shore of Chappaquiddick Island could be reached and the work extended westward as far as the lateness of the season would permit.

A self-registering tide gauge was established at Edgartown Light-House, and subsidiary gauges at the railroad bridge and at Bath House Wharf on Chappaquiddick Island. The mean range of the tide at Edgartown tidal station was found to be 2·20 feet.

Work was continued until October 19, when the party was disbanded and Mr. Marindin returned to Washington. During the latter part of the season the weather was very unfavorable and much delayed the progress of the work, and on October 10 a severe gale did considerable damage to the camp and outfit.

The results of the season's work are shown on two hydrographic sheets and on the progress sketches which accompanied Mr. Marindin's report, and the statistics furnished are as follows:

Number of cross sections laid out	226
Number of cross sections sounded	266
Number of angles to determine soundings on cross sections	5 636
Number of angles to determine theodolite stations	1 522
Number of miles of levels run	23·2
Number of miles of levels on cross sections	14·6
Number of permanent bench marks established	11
Number of tidal stations	8

Mr. Marindin commends highly the efficiency and zeal of Messrs. Safford, Griswold, and Marshall.

Mr. Marindin was occupied at the office in Washington until the close of the fiscal year in working up the results of his season's field operations and in preparing a report on the changes of the bar at the entrance of Nantucket's inner harbor since 1888. This paper will appear as an appendix to this report.

Hydrographic resurveys in Nantucket Sound and hydrographic examination in Narragansett Bay.—The steamer *Blake*, Lieut. G. W. Mentz, U. S. N., Assistant, Coast and Geodetic Survey, commanding, was undergoing repairs at New York from June 30 to July 31. Under instructions from the Superintendent, the *Blake* arrived at Hyannis, Mass., August 3, and began the resurvey of that part of Nantucket Sound between Falmouth and Hyannis and Hyannis and Great Point. Tidal observations were made night and day from August 6 to September 6 at a gauge established at Hyannis. Another gauge was established at Monomoy Island, and a series of continuous observations for a plane of reference for that part of the sound were made from September 24 to October 26, and the planes of the two gauges were related to each other by simultaneous observations on September 25 and 26.

The hydrographic work was platted on two sheets on scales of 1–20 000 and 1–40 000, but owing to unfavorable weather neither of the sheets were completed when the work was brought to a close on December 1, 1894.

After leaving Nantucket Sound the *Blake* made a successful search in the vicinity of Wickford Harbor for the rock upon which the steamer *General* had struck earlier in the year, and determined its position. The *Blake* reached New York on December 14.

Lieutenant Mentz speaks in terms of the highest praise of the services of Lieutenant Tillman, and commends the zeal of the other officers and men in the performance of the duties assigned to them.

The following officers served on the *Blake:* Lieut. G. W. Mentz (commanding), Lieut. J. A. Shearman, Lieut. E. H. Tillman, Ensign H. K. Hines (from October 27), P. A. Engineer K. McAlpine, Asst. Surg. B. R. Ward, and W. S. Crosby, pay yeoman and recorder.

The following are the statistics of the season:

Area sounded, in geographical miles	73
Number of geographical miles run while sounding	819
Number of angles measured	6 389
Number of soundings	43 285
Number of tidal stations established	2
Number of hydrographic sheets	2

At the close of the season the *Blake* proceeded to New York for necessary repairs, and in the latter part of the fiscal year Lieutenant Mentz was directed to resume the work and to make certain special examinations in Nantucket and Vineyard sounds. The results will be duly set forth in the next annual report.

Town boundary line surveys for the State of Massachusetts, continued under the direction of the Topographical Survey Commission of the State.—Assistant Henry L. Whiting, during the fiscal

year, continued to serve as chairman of the Topographical Survey Commission of the State of Massachusetts, and under his direction the work was carried forward westerly from the limits reached in the previous field season. This work was originally commenced in the cities and towns on, or near, the seacoast because of the advantages and facilities afforded by the numerous triangulation points of the Coast and Geodetic Survey, which gave already-determined bases, but as the survey extended into the interior of the State these determined points became more sparse, and it became necessary to interpolate others by means of a secondary triangulation. The execution of this supplemental triangulation was assigned to Assistant C. H. Van Orden, but he was unable to take the field in person until October 1, as he was engaged from July to September, inclusive, on running a line of levels from Albany to Dobbs Ferry, N. Y., as mentioned elsewhere in this report. Two other parties, however, were in the field early in the season connecting the town boundaries with the existing triangulation; these parties were under the charge, respectively, of Messrs. E. E. Peirce and W. C. Hawley. Mr. Peirce continued the surveys in Middlesex County to the close of the field season of 1894, and in the spring of 1895 transferred his party to the Connecticut River Valley, determining the valley townships from the Connecticut State line northward. Mr. Hawley was assigned to duty in the southeastern part of Worcester County, and remained in the field from July to October.

Assistant Van Orden took up the triangulation east of the Connecticut River on October 1, and continued in the field until the end of November. Work was again resumed in the spring, but Mr. Van Orden, having meanwhile been granted a six month's furlough, the charge of the party was given to Mr. James B. Tolley. The work was still in progress at the close of the fiscal year.

The original descriptions of the main triangulation stations, with sketches, their geographical positions and other data necessary for the prosecution of this work, have been furnished to the State Commission by the Coast and Geodetic Survey Office.

Assistant H. L. Whiting, in addition to his duties in connection with the State survey, has had general supervision over the survey of Boston Harbor and vicinity, as mentioned under that head, and from time to time inspected the work of the topographical parties; he has also continued to serve as a member of the Mississippi River Commission, and attended the various meetings of that body during the year. The first meeting was held at New York in August, 1894; the second at St. Louis, Mo., in November, and on this occasion the semiannual inspection of the river from the mouth of the Ohio to the head of the passes was made; the third meeting was also held at St. Louis in March, 1895, and the second inspection of the river was then made; the fourth and last meeting was held in New York in June, 1895.

A special report on the changes in New Orleans Harbor was presented by Assistant Whiting at the June meeting of the Commission, and will probably appear in their annual report.

Hydrographic examinations, and additional hydrography in Narragansett Bay and vicinity.—The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., after the completion of the hydrographic examinations in Buzzards Bay, Massachusetts, proceeded to Narragansett Bay and made a search for a shoal which had been reported as existing off the west side of Hog Island. The shoal was found and a thorough hydrographic survey was made of the vicinity. The shoal has a depth of 15 feet at mean low water. Additional hydrography was then executed in Potters Cove, the northern part of Sakonet River, and "The Cove." Lieutenant Garrett, on the completion of this work, proceeded with his vessel to his regular season's work in Long Island Sound.

The statistics of the work in Narragansett Bay and vicinity are as follows:

Number of miles of sounding lines run (geographical)	22
Number of angles measured	91
Number of soundings taken	1 826
Area surveyed, in square geographical miles	2

Close of the record at the automatic tide gauge station at Newport, R. I.—The tide gauge station at Fort Adams, Newport, R. I., established in March, 1892, was discontinued on February 7, 1895, the record for the fiscal year being completed to that date, and the series from 1892 being sufficient for the purposes of this Survey. Mr. David Hamilton conducted the observations as heretofore, under the superintendence of the United States engineers stationed at the post, who kindly consented to render this service.

Hydrographic examinations in Long Island Sound.—The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., after the completion of the special examinations in Narragansett Bay, described above, made a hydrographic examination along the northern shores of Long Island Sound from Fishers Island to Throgs Neck. A large number of rocks were located and many special features developed, the season's work closing in November.

Lieutenant Garrett, with his party, also assisted in the establishment of the range signals for the naval speed-trial course in Long Island Sound between Cornfield Point and Stratford Shoal, and located the red sector of the light-house on Execution Rocks. After the completion of this work, Lieutenant Garrett, with his vessel, proceeded to the mouth of Delaware Bay for the purpose of making a hydrographic resurvey of the breakwater anchorage.

The statistics of the Long Island Sound work are as follows:

Area surveyed, in square geographical miles	10
Number of geographical miles run in sounding	328
Number of angles measured	6 186
Number of soundings taken	24 350

The naval officers attached to Lieutenant Garrett's party during the season were Lieut. John J. Blandin, Ensign C. P. Plunkett, Pay Yeoman C. Lee Green, Machinist A. J. Miskimon, and Writer Eugene Veith.

At the close of the season Ensign C. P. Plunkett was relieved by Ensign C. M. McCormick, and Machinist A. J. Miskimon resigned and was replaced by Mr. J. C. Richards, who was transferred from the Coast and Geodetic Survey steamer *Blake*.

Continuation of the topographical resurvey of the south shore of Long Island.—Before the close of the previous fiscal year Assistant C. T. Iardella had taken the field for the continuation of the topographical resurvey of Long Island from the vicinity of Bellport westward to Patchogue, and eastward to Center Moriches, and thence to Speonk. This work was carried on until October 19, when the party was disbanded, and Mr. Iardella returned to Washington.

The statistics of the season's work are as follows:

Area surveyed, in square statute miles	34
Length of shore line of creeks, in statute miles	5
Length of roads, in statute miles	100
Number of topographic sheets	3¼

Mr. F. F. Weld, who was assigned to the party as recorder, rendered acceptable service.

Mr. Iardella reports that upon the shores of East Bay numerous hotels and cottages have been erected, and the locality has acquired considerable reputation as a healthful and attractive summer resort.

In June, 1895, Assistant Iardella was directed to resume the Long Island work, and at the close of the fiscal year had organized his party at Speonk.

Aid H. C. Denson was assigned to the party, and Messrs. Richard B. Derrickson and R. J. Griffin, jr., were appointed as rodmen.

The statistics of the work will appear in the next annual report.

Continuation of the tidal record at Fort Hamilton, New York Harbor, by a self-registering gauge.—The self-registering tide gauge at the Fort Hamilton tidal station, established in December, 1892, has continued in operation during the whole fiscal year, and no break has occurred in the record. Observer J. J. Spaulding has continued in charge of the gauge, and has made the monthly tabulations and forwarded them with the maregrams to the office.

The tidal indicator at this point has also continued in use, and has proved very valuable to the maritime interests of the harbor. A similar indicator will shortly be established on the Delaware River at Reedy Island, an appropriation for that purpose having been inserted in the appropriation act for the fiscal year 1896.

Continuation of the tidal record at the automatic tidal station at Willets Point, New York.—The self-registering tide gauge set up at Willets Point in July, 1891, has continued in operation during the whole fiscal year, and has furnished a valuable continuous record as heretofore. The United States engineer officers stationed at the post have kindly attended to the gauge and transmitted the records.

Continuation of the topographic survey of the Hudson River.—The continuation of the topographic survey of the Hudson River northward from the work of 1892 was assigned to Assistant John W. Donn, who, as stated in the last annual report, made his headquarters at Newburg, where the only steam ferry within a radius of 16 miles connects the two shores of the river.

It was found in general that the progress of improvements or the degradation caused by excavations made by brick manufacturers had destroyed the reference marks of the old triangulation near the river shore. It was therefore necessary to use the line Prospect Hill—Bald Hill of the triangulation of 1854–1856—as a base for establishing new points required in topographic work.

The season's work begun June 17 and closed October 30, and during that time the topography was extended northward from Newburg to Matteawan.

The principal statistics of the season's work are as follows:

Area of triangulation, in square statute miles	49
Number of geographical positions determined	7
Area of topography, in square statute miles	13
Length of shore line of rivers, in statute miles	11
Length of railroads, in statute miles	13
Length of roads, in statute miles	67
Topographic sheets finished, scale 1-10 000	1

Resumption of the survey of the Hudson River in the spring of 1895.—In order to expedite the completion of the Hudson River survey it was deemed expedient to detail two parties to this locality, a larger force being precluded by the limited appropriations and by the necessity of taking up other equally important work.

Assistants John W. Donn and William C. Hodgkins were therefore instructed to organize parties and begin operations in the latter part of June, 1895. Before executing the topography, however, it will be necessary to extend the limits of the triangulation in order to furnish the requisite geographical positions.

Messrs. H. P. Izard, Frank S. Nichols, and C. J. Skinner have been assigned to Assistant Donn's party and Messrs. Ed. Meredith and John J. Carlisle to that of Assistant Hodgkins; other necessary employees will be engaged in the locality of the work.

The statistics of the season will appear in the next annual report.

Leveling operations in New York, from Greenbush to Dobbs Ferry.—In the early part of the fiscal year Assistant C. H. Van Orden was temporarily relieved from duty under the direction of the Town Boundary Survey of Massachusetts and directed to run a double line of levels from the so-called "Grist Mill" bench mark at Greenbush to the Coast and Geodetic Survey primary bench "V" at Dobbs Ferry. The party was organized and work begun July 2 and continued to September 25, when the lines were completed. Mr. Van Orden assumed for the height of the bench mark at Greenbush the value obtained by him in 1893 when leveling to that point from Boston, and his result at Dobbs Ferry is that bench mark "V" is 10·388 feet above mean tide level at Boston. A previous determination of the Dobbs Ferry bench mark by a line of levels from Sandy Hook gives its elevation above mean sea level of that place as 9·525 feet. This discrepancy—0·863 feet—is rather large for the distance run, but does not necessarily indicate an error either in the line from Boston via Greenbush or in the one from Sandy Hook, as the identity of the planes of mean sea level at the two starting points has not yet been established.

On the completion of the leveling work Assistant Van Orden returned to Boston and resumed his duties under the direction of the Massachusetts Topographical Town Boundary Commission.

Geodetic operations.—Continuation of the reconnaissance and triangulation in southern New Jersey.—In accordance with instructions dated June 27, 1894, Prof. E. A. Bowser, Acting Assistant, resumed the geodetic work in southern New Jersey on July 5. The first work of the season was the building of a tripod and scaffold signal 64 feet high at Burden, and temporary observing signals at Colsons, Bridgeton, and Lippincott, their heights ranging from 48 to 55 feet. These elevations were necessary to avoid expensive cutting of lines through the timber. A successful search was then made for the underground mark at Pine Mount, buried in 1839, and a signal 61 feet high was erected over the old point.

The regular triangulation observations were begun at Burden Station on the 4th of August and completed September 5. Pine Mount station was re-marked so that it may be recovered whenever necessary in the future. A cone sunk to the depth of 4·5 feet was used for the underground mark, and over it was placed a granite monument 3·5 feet long, dressed 6 inches square, and with the letters "U. S." cut on each of its four sides and a triangle on the top. The whole was set in hydraulic cement to within 6 inches of the top, and a full description, with sketch, accompanies Professor Bowser's report.

The season's work closed on September 5, and Professor Bowser returned to New Brunswick, and at the date of his report, October 1, the computations and progress sketch had been completed.

The statistics of the work are as follows:

Area of triangulation, in square statute miles	250
Number of signal poles erected	6
Number of tripod and scaffold signals erected	1
Number of stations occupied for horizontal and vertical measures	1
Number of geographical positions determined	6

On April 2, 1895, Professor Bowser resumed field work and made a reconnoissance of the lines Bridgeton-Newfield and Bridgeton-Kellogg, to determine the heights necessary for the observing scaffolds to be erected at these points. This was completed by April 9, and Professor Bowser returned to New Brunswick. This closed the work for the year, as it had been determined to discontinue the employment of acting assistants on the State geodetic work. This work will hereafter, except in special cases, be executed by the regular permanent force of the Survey.

Assistant George A. Fairfield continued in general charge of the State survey work, as in previous years, until May 12, 1895, when he was relieved from that duty in pursuance of the new policy above outlined.

Resurvey of Delaware Breakwater anchorage.—The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., on her way to Baltimore after the close of the season's work in Long Island Sound, in accordance with instructions, stopped at the Delaware Breakwater for the purpose of making a resurvey of the anchorage. The work was executed between November 20 and 26, 1894, and shows a general shoaling of about 2 feet since 1883. Lieutenant Garrett reports that the gap between the breakwater and the ice breaker has been filled and presents an appearance similar to the breakwater itself. It is all uncovered at low water, and only a few portions are covered by the average high tide.

After completing this resurvey and locating the light-ships off Delaware Bay entrance, Lieutenant Garrett proceeded with the vessel to Baltimore and immediately set about making preparations for the winter campaign on the southern coast, the special work assigned to him being the resurvey of Charleston Harbor and its approaches.

The statistics of the work in Delaware Bay are as follows:

Area surveyed, in square geographic miles	3
Number of miles (geographic) of sounding lines run	69
Number of angles measured	863
Number of soundings taken	4 128

Hydrographic examination of York Spit and vicinity, Chesapeake Bay.—Early in July, 1894, the steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., left Baltimore, Md., for the mouth of the York River for the purpose of making a hydrographic survey of the reported extension of "York Spit," the steamer *Atlantic* having reported grounding on a shoal not indicated on the Coast and Geodetic Survey charts. Work was begun on July 3, and a careful and thorough examination was made, which proved the nonexistence of a shoal in the locality indicated, and the correctness of the existing charts.

Lieutenant Garrett also determined the positions of the light-houses at Tue Marshes and Wolf Trap Spit, after which he proceeded with the vessel to Buzzards Bay, Mass. The subsequent work of the *Endeavor* will be noticed under the appropriate geographical headings.

The statistics of the work in the Chesapeake Bay are as follows:

Number of miles of sounding lines run	60
Number of angles measured	361
Number of soundings taken	1 790
Area surveyed (in square geographical miles)	3

Continuation of the tidal record at the automatic gauge station at the United States Navy-Yard, Washington, D. C.—The self-registering tide gauge, which was set up at the United States Navy-Yard at Washington, D. C., in July, 1891, was kept in operation during the entire year, under the charge of the chief of the tidal division of the Office, and, with the exception of a few short breaks caused by ice during the unusually severe winter, the record was continuous.

Precise leveling from Richmond, Va., to Washington, D. C.—This important line had previously been leveled in 1884, but the computation of the work developed a discrepancy beyond the allowable limit of error, and it was deemed necessary to revise the work. Instructions were accordingly issued March 25, 1895, to Assistant Isaac Winston to begin at the Richmond bench mark and run a double simultaneous line to Washington. Mr. Winston left Washington on April 4, accompanied by Aid A. L. Baldwin and Messrs. C. F. Smith and F. C. S. Hunter, who had been designated as members of the party, and reached Richmond the same day. Messrs. R. B. Derickson and F. C. Kendrick, also members of the party, reported to Mr. Winston on his arrival at Richmond, and the organization was complete. The instruments were adjusted the following day and the necessary instructions were given to the new rodmen, etc., and the regular work of leveling was inaugurated on the 6th. The line began on the two bench marks established in 1884 and followed the route of the Richmond, Fredericksburg and Potomac Railroad to Quantico, and that of the Pennsylvania Railroad from Quantico to Washington. The old permanent bench marks of 1884 at Ashland, Doswell, Fredericksburg, Alexandria, and Georgetown were recovered and connected with, and twelve additional permanent bench marks were established at other towns along the line. Temporary bench marks were also located at intervals of 1 kilometre to serve as comparison points as the work progressed. No special difficulties were encountered south of Quantico, but north of that point three long trestles had to be crossed. A calm day was selected for this part of the work, and the instrument and rods were placed on the trestles at the usual distances, but the precaution was taken of placing a plank across the rails for the observer to stand upon while leveling. It was found that in this way the instrument was quite steady, and that good results could be obtained. As an additional check, the first trestle was recrossed by observing the whole length directly from the banks, and the agreement of results was found to be quite satisfactory.

The bench mark on the north abutment of the Aqueduct Bridge at Georgetown (West Washington) was reached on June 28, and the party disbanded and Assistant Winston returned to the office to complete his computations and prepared for field work in the West.

During the season a new form of leveling rod, devised and constructed at the Coast and Geodetic Survey Office, was used for the first time and gave entire satisfaction. A detailed description of these rods is in course of preparation by Assistant Winston, and will appear as an appendix to this report.

Aid A. L. Baldwin rendered valuable assistance as recorder and computer in the party until May 15, when it became necessary to assign him to duty on the California and Nevada Boundary Line Survey. He was relieved by Aid H. C. Denson, who served acceptably until the close of the work.

The statistics of the leveling executed are as follows:

Length of double line leveled, in kilometres	186
Number of permanent bench marks established	12

The further services of Assistant Winston and Aids A. L. Baldwin and H. C. Denson will be noticed elsewhere in this report.

Hydrographic resurvey of Charleston Harbor, South Carolina, and its approaches.—Lieut. L. M. Garrett, U. S. N., commanding the Coast and Geodetic Survey steamer *Endeavor*, in accordance with instructions, left Baltimore, Md., in January, 1895, and proceeded direct for Charleston, S. C., for the purpose of making a resurvey of the harbor and its approaches. On arriving at Charleston he conferred with Capt. Frederick V. Abbott, U. S. A., the engineer in charge of the harbor improvement, and Commander M. R. S. Mackenzie, U. S. N., the light-house inspector of the sixth district, both of whom kindly afforded him every facility in their power for the proper execution of the work, and furnished much valuable information. The survey was begun January 24 in the Cooper and Ashley rivers at the points where the *Bache's* work of the previous year closed, and continued through the old main channel, such portions of the harbor as have recently been

surveyed by the United States engineers being omitted. Captain Abbott gave the party access to his unfinished topographical sheet, covering the greater part of the harbor, and allowed them to make a tracing of his shore line.

The low and marshy banks of the Cooper and Ashley rivers are overflowed at every high tide, and the irregular line of marsh grass forms the only visible line of demarkation, and it was therefore considered that the determined ends of the sounding lines would define the high-water shore line sufficiently well, as well in fact as it could be determined by other means. The city front shore line, wharves, etc., as shown on the tracing, were surveyed by the engineers prior to the heavy gales of two years ago, and in order to bring them up to date sextant positions and measurements, as well as soundings, were taken by Lieutenant Garrett's party along the entire city front. The shore line of Morris Island was found to have undergone considerable change since the date of the old survey. The recent triangulation of the Coast and Geodetic Survey left little to be desired in the way of determined points, and very few additional signals were required to be built. With the exception of some soundings close inshore, and a few special development lines, for which a small boat was needed, the entire inside harbor work was done by means of a 22-foot naphtha launch; the outside sounding lines were necessarily run with the steamer.

The plane of reference for the reduction of the soundings is that derived by the United States engineers from the Coast and Geodetic Survey gauge at Fort Sumter, but comparative gauges were set up at other points also, and whenever practicable the soundings were referred directly to the gauge nearest to them; in other cases a time correction was applied and the reductions made with reference to the Fort Sumter gauge. Special developments were made of all shoal spots found in or near any channel or fairway, and this part of the work was done so thoroughly that it is believed that no further resurvey of the harbor will be required for many years. The old Main Channel has partially filled up and is now practically abandoned in favor of the Jetty Channel, but sounding lines were run over it sufficiently close together to afford means of correcting the charts.

The season's work was completed by May 11, and on the 13th of May the *Endeavor* sailed for Baltimore in charge of Lieut. John J. Blandin, while Lieutenant Garrett proceeded to Washington by rail, having been ordered there by the Navy Department for examination for promotion.

The *Endeavor* arrived in Baltimore May 16, and has since been undergoing repairs.

The statistics of the Charleston Harbor work are as follows:

Area surveyed, in square geographical miles	37
Number of miles of sounding lines	625
Number of angles measured	8 302
Number of soundings taken	41 031

The list of naval officers attached to Lieutenant Garrett's party was as follows: Lieut. John J. Blandin, Ensign Charles M. McCormick, Pay Yeoman C. Lee Green, Machinist in charge J. C. Richards, and Writer Eugene Veith.

Completion of the topographic survey in the vicinity of Charleston, S. C.—In May, 1895, when preparing for publication the records of the topographic and hydrographic surveys recently made of the Cooper, Ashley, and Wando rivers, it was found that a small area, not exceeding 1 square mile, had been inadvertently omitted and not surveyed, and Assistant John W. Donn was at once detailed to supply the deficiency. He proceeded to Charleston and began the work May 26, and completed it by the end of the month, after which he returned to Washington.

Magnetic observations in various Atlantic States.—In May, 1895, Assistant J. B. Baylor was directed to determine the magnetic elements at a number of points in various States along the Atlantic Seaboard. He took the field on May 20, and by the close of the fiscal year the magnetic declination, dip and intensity determinations were completed at the following places: Savannah, Ga.; Charleston, S. C.; Cape Henry, Va.; Sandy Hook, N. J.; and Nantucket, Mass.

The old Coast and Geodetic Survey secular variation stations were reoccupied in each instance, and three days' observations were made at each, together with the necessary astronomical observations for azimuth. The work at other stations was continued after June 30, and the results will appear in the next annual report.

Examination of Charlotte Harbor entrance and search for reported shoal.—The steamer *Bache*, Lieut. Robert G. Peck commanding, while en route from Pensacola, Fla., to New York at the close of the season's work in the vicinity of Pensacola Bay, in accordance with instructions, stopped at Charlotte Harbor, Florida, for the purpose of investigating a shoal which had been reported by Capt. Thomas Jackson of the British steamer *Beaconsfield*, as existing about 4 miles SW. ¾ W. from the entrance buoy, and also making a reexamination of the bar at said entrance and determining the position of the light-house. The *Bache* reached Charlotte Harbor on the 13th of May and work was begun at once. A thorough search, in which Lieutenant Peck was assisted by all the pilots of Gasparilla Island, failed to discover the alleged shoal, although a wide area was examined and sounded, and Lieutenant Peck reports that he is satisfied that no such shoal exists. The pilot who took the *Beaconsfield* into the harbor was one of those who assisted in the search. A thorough examination was also made of the channel leading over the bar and into Charlotte Harbor, and the so-called 16-foot shoal in the channel way was definitely located. Sundry prominent objects suitable for land marks and ranges were determined, after which the *Bache* proceeded on her way to New York, where she arrived May 25.

Examination of Palatine Shoal, off Tampa Bay, Florida.—In accordance with instructions, Lieut. Robert G. Peck, commanding the Coast and Geodetic Survey steamer *Bache*, while en route to Pensacola Bay to continue the hydrographic survey from the point reached by the steamer *Blake* during the previous year, stopped at Tampa Bay for the purpose of making an examination of the Palatine Shoal, and determining the position of buoys, beacons, wharves, and prominent buildings. The *Bache* arrived at Tampa Bay January 25, and after some delay, due to bad weather, a sufficient number of old stations were recovered and the work of sounding proceeded. Three shoal spots were found, the unreduced depths being 19½, 19¾, and 20½ feet, situated respectively about 197 metres west southwest, 162 metres southwest, and 344 metres south by east from the U. S. buoy placed to mark the shoal. A careful examination was made of the whole locality, but these were the least depths found. The soundings were taken at about half tide, but as no tide gauge was set up the amount of reduction to be applied is uncertain. It is probable, however, that as the wind had for some time been blowing constantly from the southward the general level of the water was raised considerably above the normal, and a reduction of 2 feet would not seem excessive.

The objects determined for indication on the chart were the entrance buoys, tank of quarantine station, wharf of quarantine station, house near north end of Anna Maria Key, new beacons in the north and southwest channels, pilot lookout station, hospital of quarantine station, and house near south end of Egmont Key.

Lieutenant Peck reports some changes in the shore line since the date of the last survey, especially at the north end of Mullet Key, where a considerable amount of washing away has taken place.

The *Bache* then proceeded to Pensacola, where she arrived February 3. Her work in that region is described in the following paragraph:

Completion of the topographic resurvey of Pensacola Bay and its tributaries.—Under instructions dated December 17, 1894, Assistant P. A. Welker proceeded early in January to Pensacola, Fla., and organized a party for the completion of the survey of the remaining parts of Pensacola Bay and its tributaries. The schooner *Transit*, being of light draft, was placed at his disposal, the first work being in Big Lagoon, where the waters are shallow; but subsequently the party was transferred to the schooner *Quick*, a much more comfortable and commodious vessel.

Assistant John Nelson and Aid R. L. Faris were assigned to the party, and reported to Assistant Welker at Pensacola in time to assist in the fitting out and equipment of the vessel. Field operations were begun January 11, and as most of the old triangulation points were recovered without difficulty (some of the signals still remaining standing), the interpolation of but few additional points was necessary and the topographic work proceeded without delay. Considerable stormy weather was experienced, and some time was lost in consequence, but nevertheless the progress made was very satisfactory. Mr. Welker, in his report, expresses his high appreciation of the excellent services rendered by Assistant John Nelson and Aid R. L. Faris, and attributes much of the successful outcome of the season's work to their zeal and efficiency.

While at Pensacola Navy-Yard Mr. Welker availed himself of the opportunity to redetermine the magnetic elements, and the regular series of three days' observations were made for declination, dip and intensity. He also, by direction of the Superintendent, disposed of, at public sale, a lot of condemned property which had gradually accumulated aboard the Survey vessels and at the navy-yard.

The season's work closed on March 23, and the vessels were laid up in charge of a ship keeper, the party disbanded, and Messrs. Welker, Nelson, and Earis proceeded to Washington. Their subsequent services during the fiscal year will be mentioned elsewhere in this report.

The statistics of the Pensacola Bay work have been tabulated as follows:

Number of miles of shore line surveyed	76⅛
Number of miles of roads and railroads surveyed	98
Number of miles of creeks surveyed	8
Number of miles of swamp line surveyed	53
Area of topography surveyed, in square statute miles	49
Number of topographic sheets completed	4½
Number of stations occupied for horizontal angles	2
Number of magnetic stations observed	1

Continuation of the hydrographic resurvey in Pensacola Bay and vicinity.—In December, 1894, Lieut. Robert G. Peck, commanding the steamer *Bache*, was directed to resume the hydrographic resurvey of Pensacola Bay and vicinity. The *Bache*, having been prepared for sea, left New York, January 9, 1895, and arrived at Pensacola February 3. Several brief stops were made en route, viz, at Hampton Roads, in consequence of bad weather; at Key West, Fla., to overhaul machinery and obtain fresh water; at Punta Rasa, Fla., to take in tow the schooner *Spy*, laid up at that point in charge of a ship keeper; and at Tampa Bay, Florida, to make an examination of Palatine Shoal, as above reported.

The work assigned to the *Bache* was embraced on four projections furnished by the office, and numbered 2, 4, 5, and 7, respectively, on the general scheme. Nos. 5 and 7 covered East Bay; No. 4, that part of Pensacola Bay extending from the city of Pensacola to East Bay; No. 2, the bar and entrance and that part of the bay extending from the entrance to a point a short distance beyond the navy-yard. In addition to these, sheet No. 3, including that portion of the bay abreast of the city and extending southward to Santa Rosa Island, and the hydrography of which was executed by the *Blake* in the early part of 1894, was also sent to Lieutenant Peck for special developments. All of the work thus assigned was completed, excepting sheet No. 2, which had to be postponed to another season.

The *Bache*, on May 11, left Pensacola for New York, stopping en route at Charlotte Harbor, Florida, for special examinations in that locality, as already noticed, and arrived at New York May 25.

The list of officers attached to Lieutenant Peck's party is as follows: Lieut. E. H. Tillman, U. S. N.; Ensigns G. W. Kline, H. K. Hines, A. H. Davis, and F. M. Russell; P. A. Surg. G. H. Harber; Asst. Eng. A. McAllister; Pay Yoeman J. L. Dunn; and Recorders, Thomas S. Martin and William H. De Luce.

The statistics for the season's work are given as follows:

Area sounded, in geographical miles	54·8
Number of miles of sounding lines	1 340·5
Number of angles measured	12 761
Number of soundings	85 366
Number of tidal stations established	4
Number of finished hydrographic sheets	3
Number of special examinations (Tampa Bay and Charlotte Harbor)	2

At the close of the fiscal year the *Bache* was preparing for the resumption of work on the coast of Massachusetts.

Continuation of the triangulation of the oblique arc in Alabama.—In March, 1895, Assistant F. W. Perkins was directed to proceed to Mobile and arrange for the continuation of the main triangulation through the southern part of the State of Alabama. This triangulation forms part of the great oblique arc, and its terminus will be Mobile Bay. Mr. Perkins arrived at Mobile

on the 18th of March, and as the reconnaissance had previously been completed and sites selected for the observing stations, the first work to be undertaken was the building of the signals. The experience gained on the transcontinental arc in Indiana, Illinois, and Ohio had amply demonstrated the practicability of attaining a high degree of accuracy in the measurement of angles from towers 100 feet or more in height, and on account of the great economy of time resulting from their use in a heavily timbered country, the reconnaissance in Alabama was made with a view of building high signals rather than resorting to the cutting of expensive lines of sight through the heavy timber. Furthermore, the new method of building signals, devised by Assistant Perkins, has materially lessened the cost of such structures, the signals built during this season occupying each, on an average, only seven and a half days, exclusive of time spent in traveling from one point to another and getting the lumber on the ground.

By the 8th of June six towers were completed, their heights ranging from 80 to 120 feet, although an unprecedented number of rainy days (thirty-three) occurred during May and June. Work was carried on through the rains regardless of considerations of personal comfort. By June 8 the allotment of funds for the work was so nearly expended that it was necessary to reduce the numerical strength of the party for the remainder of the month, and the signal building was therefore discontinued until the new appropriation became available. The time was utilized, however, in verifying lines of sight and executing such cutting as was essential. The party is still in the field, the observing to be taken up as soon as all the signals are erected. The results of the complete season's work will be given in the next annual report.

Laying out of a true meridian line at Terre Haute, Ind.—In October, 1894, Assistant G. R. Putnam, while occupying the Terre Haute Station for the determination of gravity, laid out, at the request of Prof. M. A. Howe, a true meridian line for the use of engineers and local surveyors in testing the needles of their compasses and determining the changes of magnetic declination.

Geodetic operations.—Continuation of the triangulation in northeastern Tennessee and southeastern Kentucky, and along the Kentucky, Virginia, and Tennessee State lines.—On the 11th of June, 1894, the party under the charge of Prof. A. H. Buchanan, Acting Assistant, took the field for the extension of the Tennessee and Kentucky triangulation to the northward and eastward toward a junction with the primary work lying between the Maryland and Georgia base lines. Work was continued until October 18, when the party was disbanded and Professor Buchanan returned to Lebanon.

Good progress was made during the season, and the weather, except when the party was occupying Rogers Station, was generally favorable. At Rogers Station a long period of unusually hazy and foggy weather seriously delayed the party, the occupation of that station consuming ten weeks. Roan High Bluff, on the other hand, also a primary station, was completed in two weeks.

The party was again organized, and took the field about the middle of June, and is now making the usual progress. Four additional stations were established during the year, and horizontal and vertical measures were made at three primary and six secondary stations, the former being at English, Rogers, and Roan High Bluff, and the latter at Chimney, Holston, Clinch, Briston, Dunn, and Damascus.

A sketch showing the progress made and the relative positions of the stations occupied, accompanies Professor Buchanan's report.

Determination of relative gravity with half-second pendulums, and other pendulum investigations.—The pendulum campaign inaugurated in March, 1894, resulted in the determination of six stations up to the close of the fiscal year, as described in the last annual report, and since that time of twenty additional ones in a transcontinental series extending as far west as Utah, and generally in the neighborhood of the thirty-ninth parallel of latitude. The work was under the charge of Assistant G. R. Putnam, and the reference or base station, as before, was the one specially fitted up for the purpose in the basement of the United States Coast and Geodetic Survey Office at Washington, D. C. This line of gravity stations was carefully selected, and, including as it does a wide variety of orographic features, and altitudes varying from 14 to 4 285 metres above sea level, is peculiarly well adapted to throw light on the continental variations of gravity, the proper method of reduction to sea level, and questions relating to the nature and condition of the earth's crust. The question of the proper method of reduction to sea level is of primary importance in connection

with the application of gravity measurements to the problem of the earth's figure. Several stations were selected on account of peculiar local features, and others with a view to obtaining data for computing the earth's mean density. The comparison of results with different kinds of apparatus and with pendulums of different lengths was also borne in mind in the selection, and four of Commandant Defforges's stations of 1893 were therefore included; also at three stations, in addition to the regular observations with the half-second pendulums, independent observations with a quarter-second (one-sixteenth metre) pendulum apparatus recently constructed at the Coast and Geodetic Survey Office were made.

The latitudes and longitudes of the stations were mostly derived directly or indirectly from previous Coast and Geodetic Survey determinations, but at eight stations they were determined by actual observation, the latitudes by the usual method and the longitudes by chronometric differences of time. The elevations were obtained from the most accurate data available.

As Mr. Putnam's detailed report on this work is published in full as Appendix No. I, in Part II, of the Report for 1894, it is not necessary here to give a description of the improved instruments used or the methods of observations adopted, but simply a brief notice of the stations belonging to the three geographical divisions. Those belonging to the Middle and Western divisions will be mentioned also under their appropriate headings.

The stations already described in the last fiscal year's report are Washington, D. C.; Boston, Mass.; Cambridge, Mass.; Princeton, N. J.; Ithaca, N. Y.; Philadelphia, Pa.; and Charlottesville, Va. The additional stations in the Eastern Division observed during the present fiscal year are Deer Park, Md.; Cleveland, Ohio; Cincinnati, Ohio; Terre Haute, Ind.; and Chicago, Ill. The stations of the Middle Division are St. Louis, Mo.; Kansas City, Mo.; Ellsworth, Kans.; and Wallace, Kans. Those of the Western Division are Colorado Springs, Colo.; Denver, Colo.; Pikes Peak, Colorado; Gunnison, Colo.; Grand Junction, Colo.; Green River, Utah; Grand Canyon, Wyoming; Norris Geyser Basin, Wyoming; Lower Geyser Basin, Wyoming; Pleasant Valley Junction, Utah; and Salt Lake City, Utah.

The station at Deer Park, Md., was located at the east corner of the swimming-pool building, west of the Deer Park Hotel, and the instruments were supported on a stone pier built for the purpose. The latitude of the station is 39° 25′ 02″ N., the longitude 79° 19′ 50″ W., and the elevation above mean sea level 770 metres.

At Cleveland, Ohio, the station was located in the west corner of the basement of Adelbert College, in the "balance room" of Professor Morley, the instruments being supported on a large brick pier with capstone. The latitude is 41° 30′ 22″ N., longitude 81° 36′ 38″ W., and elevation above mean sea level 210 metres.

At Cincinnati, Ohio, the station was the Cincinnati Observatory, on Mount Lookout, in the basement, north of the foundation of the meridian circle, on a brick pier. Latitude 39° 08′ 20″ N., longitude 84° 25′ 20″ W.; elevation above mean sea level, 245 metres.

At Terre Haute, Ind., the station was the west room of the basement of the main building of the Rose Polytechnic Institute, on a large brick pier topped with slate. Latitude 39° 28′ 42″ N., longitude 87° 23′ 49″ W.; elevation above mean sea level, 151 metres.

At Chicago, Ill., the station was located on a massive brick pier in the "constant temperature room," northeast part of main floor of the Ryerson Physical Laboratory, University of Chicago. Latitude 41° 47′ 25″ N., longitude 87° 36′ 03″ W.; elevation above mean sea level, 182 metres.

At St. Louis, Mo., the pendulum station was located on a pier in the south basement room of the chemical laboratory of the Washington University, near the northwest corner of St. Charles and Seventeenth streets. Latitude 38° 38′ 03″ N., longitude 90° 12′ 13″ W.; elevation above mean sea level, 154 metres.

At Kansas City, Mo., the apparatus was supported on bricks cemented to the concrete floor of a small storeroom in the south part of the basement of the Franklin School, at the northeast corner of Washington avenue and Fourteenth street. Latitude 39° 05′ 50″ N., longitude 94° 35′ 21″ W.; elevation above mean sea level, 278 metres.

At Ellsworth, Kans., the station was on a large stone doorsill, near the center of basement of the court-house of Ellsworth County. Latitude 38° 43′ 43″ N., longitude 98° 13′ 32″ W.; elevation above mean sea level, 469 metres.

At Wallace, Kans., the station was on a stone doorsill in the basement of a stone residence belonging to the Union Pacific Railway, and situated a short distance northwest of the railroad station. Latitude 38° 54′ 44″ N., longitude 101° 35′ 26″ W.; elevation above mean sea level, 1 005 metres.

At Lower Geyser Basin, Wyoming (Yellowstone Park), the station was on a brick pier built for the purpose in an unfinished basement room in the north end of the central wing of the Fountain Hotel. Latitude 44° 33′ 21″ N., longitude 110° 48′ 08″ W.; elevation above mean sea level, 2 200 metres.

At Norris Geyser Basin, Wyoming (Yellowstone Park), the station was in a small room at the entrance to storehouse, west of lunch station. Three wooden posts driven into the ground and well braced served as a support for the pendulum apparatus. Latitude 44° 44′ 09″ N., longitude 110° 42′ 02″ W.; elevation above mean sea level, 2 276 metres.

At Grand Canyon, Wyoming (Yellowstone Park), the station was on a brick pier built for the purpose in the unfinished basement of the west end of the main building of the Canyon Hotel. Latitude 44° 43′ 16″ N., longitude 110° 29′ 44″ W.; elevation above mean sea level, 2 386 metres.

At Salt Lake City, Utah, the gravity station was on a stone pier in the small astronomical observatory in the southeast corner of Temple Block. Latitude 40° 46′ 04″ N., longitude 111° 53′ 46″ W.; elevation above mean sea level, 1 322 metres.

At Pleasant Valley Junction, Utah, the station was on a brick pier built for the purpose in the west corner of the cellar under the residence of Mr. T. Arrowsmith, about 65 metres north of the Rio Grande Western Railway station. Latitude 39° 50′ 47″ N., longitude 111° 00′ 46″ W.; elevation above mean sea level, 2 191 metres.

At Green River, Utah, the station was on a brick pier built in the east corner of the cellar under the south part of the Palmer House. Latitude 38° 59′ 23″ N., longitude 110° 09′ 56″ W.; elevation above mean sea level, 1 243 metres.

At Grand Junction, Colo., the station was on a new brick pier of the cellar under the northeast corner of the Brunswick Hotel, Main street, west of Fourth. Latitude 39° 04′ 09″ N., longitude 108° 33′ 56″ W.; elevation above mean sea level, 1 398 metres.

At Gunnison, Colo., the station was on a heavy stone door sill of a small room beneath the sidewalk at the northeast corner of the La Veta Hotel. Latitude 38° 32′ 33″ N., longitude 106° 56′ 02″ W.; elevation above mean sea level, 2 340 metres.

At Colorado Springs, Colo., the gravity station was on a pier in a small room near the northeast corner of basement of Hagerman Hall, Colorado College. Latitude 38° 50′ 44″ N., longitude 104° 49′ 02″ W.; elevation above mean sea level, 1 841 metres.

At Pikes Peak, Colorado, the gravity apparatus was supported on large stones cemented to the concrete floor of the small storeroom at the south end of the Stone Building on the east side of the summit of the mountain. Latitude 38° 50′ 20″ N., longitude 105° 02′ 02″ W.; elevation above mean sea level, 4 293 metres.

At Denver, Colo., the pendulum apparatus was supported by large stones cemented to the concrete floor of the basement of the Chamberlain Observatory of the University of Denver, located in University Park. The station is a short distance south of the equatorial foundation. Latitude 39° 40′ 36″ N., longitude 104° 56′ 55″ W.; elevation above mean sea level, 1 638 metres.

The base station for all of the above is a massive brick pier with capstone, built in the "pendulum room" of the southwest corner of the basement of the United States Coast and Geodetic Survey Office at Washington, D. C. Latitude 38° 53′ 13″ N., longitude 77° 00′ 32″ W.; elevation above mean sea level, 14 metres.

The season's work closed on October 26, when, the available funds being exhausted, the party returned to Washington.

The average time required per station, including traveling and all incidental delays, was only five and one-fourth days, and the average expense per station was approximately $60. This rapidity of work was largely due to remarkably favorable weather conditions, there being only two days' delay during the season caused by inability to obtain time observations.

The work at a station comprised the setting up and adjusting the apparatus, swinging the pendulums continuously for at least forty-eight hours, making time observations each favorable

evening, connecting the station with known points, both as regards geographical position and elevation, or determining the latitude and longitude when necessary, and keeping up the field records and computations. Certain additional work was also carried on, as follows: The testing of a set of smaller pendulums by swinging them simultaneously with the others at three stations; testing the wear of the pendulum knife edge by swinging the half-second pendulums on an additional standard edge at two stations; and laying out of meridian lines at Colorado Springs, Colo., and Terre Haute, Ind.

On Assistant Putnam's arrival at Washington he reoccupied the Washington base station, determining the periods of both sets of pendulums; he also investigated the temperature coefficients of the small pendulums and completed and checked his records and computations. He was then employed on miscellaneous office duty until sent again to the field on telegraphic longitude determinations in the Southwest, as described in another part of this report.

From July 1 to September 16 Mr. Putnam was assisted by Mr. C. E. Mendenhall, extra observer, but after that date he executed the work alone.

The importance of gravity determinations, aside from their bearing on problems of geodesy, is becoming widely recognized, especially in geologic research. Mr. G. K. Gilbert, of the United States Geological Survey, who during the summer visited ten of Assistant Putnam's pendulum stations for the purpose of making a study of the geology in connection with the gravity results, has made an interesting report on the subject, which is published with Assistant Putnam's paper in Appendix I, Part II, Report for 1894.

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

MIDDLE DIVISION.

STATES AND TERRITORIES BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

28. Minnesota.
29. North Dakota.
30. South Dakota.
31. Iowa.
32. Nebraska.
33. Missouri.
34. Kansas.
35. Arkansas.
36. Indian Territory.
37. Oklahoma Territory.
38. Louisiana.
39. Texas.

Progress Sketches Nos. 2, 10, 15, and 5, 6, 7, 16, show the localities of field work in the Middle Division. A list of Progress Sketches will be found at the close of this volume.

Geodetic and topographical operations in Minnesota.—Continuation of the triangulation and topography in the vicinity of Minneapolis and St. Paul.—At the beginning of the fiscal year the party under the charge of Assistant W. C. Hodgkins was stationed at Minneapolis, having begun the preliminary operations in June, in consequence of a previous request from the State topographer and the regents of the State University, for the determination of additional points in the vicinity of the cities of Minneapolis and St. Paul, with a view to inaugurating a topographical survey of the State of Minnesota. After conference with the State topographer, Prof. William R. Hoag, it had been decided that as far as possible these points should be determined by the graphic methods of the plane table, and at his suggestion it was further decided to extend the work from the mere determination of trigonometric points to a thorough exposition of the methods in use in the Coast and Geodetic Survey for the determination of topographic forms and artificial detail. This proposition, contemplating the instruction of the State topographers in the use of the plane table, and being, therefore, of benefit mainly to the State topographical survey, was approved and accepted by the Superintendent only on the condition that the State of Minnesota should bear all expenses of the work except the pay and subsistence of Assistant Hodgkins and Acting Assistant W. R. Hoag, the latter being also an active member of the party. After completing a projection on a scale of 1-20 000 it was found that the number of triangulation points in some sections was rather limited, and a few additional ones were added in the usual manner. The principal stations of the triangulation were then occupied with the plane table and lines obtained to a large number of prominent objects, the intersection of these lines completing the determination of the objects observed upon. Numerous other points were determined by the methods of resection, and these methods were also carefully explained to the State topographers. Heights were also determined at each station by means of vertical angles. All the topographic details obtainable at any station were delineated before moving to the next, and finally a complete topographic survey of a portion known as the "midway district" was taken up and carried as far as the remaining time at the disposal of the party would permit.

During the season, as opportunity offered, detailed surveys were made of detached localities of special interest, e. g., Minnehaha Park with the celebrated falls of that name, portions of lakes Como, Amelia, Cedar, etc., and a part of the Mississippi River, including the famous falls of St. Anthony.

The country included within the limits of the topographical sheet is of a rolling character, rising rather gently in general from the edges of the gorge through which the Mississippi River flows, but in the vicinity of St. Paul the hills rise more abruptly from the river.

The range of elevation is about 400 feet, or from 700 feet above sea level, at the bottom of the gorge, to 1 100 feet above sea level at "Wallace" Station.

The weather was almost continually hot and dry, and the party suffered much discomfort in consequence.

Field work was closed and the party disbanded on September 27, and Mr. Hodgkins then proceeded to Washington, D. C., where he was engaged on miscellaneous office duty until again ordered to the field. His subsequent services in Chesapeake Bay and on the Hudson River will be mentioned under appropriate geographical headings in other parts of this report.

The statistics of the Minnesota work are as follows:

Area of topography surveyed, in square statute miles	21
Shore line surveyed, in statute miles	20
Roads and streets surveyed, in statute miles	207
Number of topographic sheets completed	1
Number of triangulation points occupied with theodolite	3

Determination of relative gravity with half-second pendulums, in the States of Missouri and Kansas.—The pendulum stations in Missouri and Kansas—St. Louis and Kansas City in the former State and Ellsworth and Wallace in the latter—were determined by the party under the charge of Assistant G. R. Putnam in September and October, 1894, and form part of the transcontinental series already mentioned under the head of the "Eastern Division." For further particulars concerning this work, see the account on page 28 et seq. of this volume, and Assistant Putnam's paper, published as Appendix No. I, in Part II of the Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1894.

Continuation of the precise leveling in Missouri and Arkansas.—Assistant Isaac Winston, under instructions dated June 8, 1894, proceeded to Lamar, Mo., leaving Washington on the 15th of June and arriving at the working ground on the 17th. The party was at once organized and preparations made to begin work, when it was discovered that the instrument had suffered damage in transportation, rendering it necessary to send it to Washington for repairs. Another level was at once forwarded so that only a few days' delay was caused by the accident. The time was profitably spent in training the rodmen and recorder in their respective duties. On June 22 the new instrument was received from Washington and leveling operations were commenced the same day. The two bench marks established at the close of the previous season were found in good condition and undisturbed. Connection was made with both and the line of levels was carried southward along the Lexington and Southern Division of the Missouri Pacific Railway at Carthage, Mo., thence along the Kansas Division of the St. Louis and San Francisco Railway to Monett, Mo., and thence along the Texas Division of the same road to Chester, Ark., where a junction was made with two bench marks whose elevation above the mean level of the Gulf of Mexico had been previously determined. This closed the gap in the line from the Gulf to Kansas City, and completed the season's work on October 9.

The season's work began on the rolling prairie or table land of southwest Missouri and extended in the mountainous region of northwest Arkansas, and the line, for convenience, followed closely the roadbed of the railroad, except at Winslow, Ark., where it was taken over the mountain to avoid the railroad tunnel at that place. A check line was, however, subsequently run through the tunnel. The method of observing was the same as before, viz, two simultaneous lines were run in one direction. Mr. Winston reports that no special obstacles were encountered during the season, but that very heavy grades were found in the mountainous region from Winslow to Chester, there being at one place a fall of over 300 metres in a distance of 18 kilometres. Some delay was caused by the strong winds peculiar to that region, but most of the route was protected by adjacent hills or forests, and very good progress was made during the season.

Bench marks were established at the various towns and villages along the line, and the elevation of the railroad track at each railroad station was determined. Velocipede cars were used by the party as a daily means of transportation to and from work, and proved very effective, and also resulted in a great saving of both time and money.

Mr. E. M. Stayton served as recorder in the party during the season, and assisted on the office work. The field computations have been completed and show very satisfactory results.

The statistics of the season's work are as follows:

Distance, in kilometres, of leveling executed	243
Number of bench marks established	27

At the close of the season Mr. Winston was excused from duty for ten days, after which he returned to Washington, and was engaged in computing his field results and on other office duty until again sent in the field in Virginia. His services in that section of the country have already been noticed under the proper head.

Subsequently he was directed to resume leveling in Kansas on the Transcontinental Line, special notice of which will appear farther on in this report.

Longitude determinations by exchange of telegraphic signals at stations in California, New Mexico, Texas, and Louisiana.—For the completion of the main scheme of longitudes in the southwestern part of the United States, the differences of longitude between Needles, Cal., and Santa Fe, N. Mex.; Santa Fe, N. Mex., and El Paso, Tex.; El Paso, Tex., and Austin, Tex.; Austin, Tex., and Galveston, Tex.; Austin, Tex., and New Orleans, La.; Austin, Tex., and Laredo, Tex., were required, and these determinations are of further importance as furnishing connections with the series of longitudes determined in 1892 for the International Boundary Commission.

All of these lines, excepting Austin, Tex., to Laredo, Tex., are of the primary class, requiring ten nights' simultaneous observation at each end and an interchange of observers in the center of the series to eliminate effects of personal equation.

The charge of this work was assigned to Assistant C. H. Sinclair, with Assistant Edwin Smith in charge of the cooperating party.

Messrs. Sinclair and Smith left Washington on February 1, 1895, the former proceeding to Needles, Cal., and the latter to Santa Fe, N. Mex., and immediately preparing the stations for occupation. On account of the excessive heat prevailing at the Needles during a large part of the year it was desirable to make the observations during the winter and early spring, and therefore these stations were first occupied. At Santa Fe, however, the season selected was not the most favorable, as on account of its high altitude severe cold was likely to be experienced. While the party was at this station temperatures as low as 15 degrees below zero were recorded, but this was unusually severe for the month of February. At the Needles, during the same period, it was not necessary to have fire in the residences or in the observatory. Cloudy weather prevailed to such an extent at the Needles during the month of February that only five exchanges of signals were obtained, viz: On the 8th, 17th, 18th, 22d, and 27th. As this completed one-half the required series the observers exchanged stations, Mr. Sinclair proceeding to Santa Fe and Mr. Smith to the Needles. The remaining required exchanges were obtained on March 4, 7, 8, 9, and 10, thus completing the line.

At the Needles the old longitude pier, located in 1889 in the grounds of the Catholic Church, was found intact, and was utilized for the new observations. Latitude was also determined by means of Zenith Telescope No. 6, using fifteen pairs of stars, and seventy-one observations were made on five nights. The latitude station, a temporary wooden structure, was located 50 inches due west of the longitude pier.

In Santa Fe the station of Lieutenant Wheeler, of the United States Engineers, located in the parade ground of Fort Marcy, and used by the Coast and Geodetic Survey in 1886, was reoccupied. The pier of this station is a single large block of stone.

The lines, Needles to Santa Fe and Santa Fe to El Paso, close two of the great circuits in the longitude scheme, and by the field computation of Assistant Sinclair the closing errors seem to be very small, being only nine-thousandths of a second in one case and twenty-three-thousandths of a second in the other—a very satisfactory result.

Magnetic observations, declination, dip, and intensity were also observed at both stations by Assistant Smith. On the completion of the line, Assistant Smith moved the Needles instruments and outfit to El Paso, Tex., Assistant Sinclair remaining at Santa Fe. At El Paso, Mr. Smith found the pier and observatory erected in 1893, in the old Government cemetery (now a city park) still standing, and preparations for beginning observations were therefore soon completed. Signals were exchanged between El Paso and Santa Fe on March 15, 16, 19, 21, and 22, and again, after the usual interchange of observers, on March 24, 25, 26, 27, and 28. This completed the line

Santa Fe to El Paso, and the instruments and outfit at the former station were next moved to Austin, Tex., by Mr. Smith, Mr. Sinclair remaining at El Paso. At Austin, in the capitol grounds, is a large meridian mark built and established by Assistant William Eimbeck, of the United States Coast and Geodetic Survey, in 1892, and the longitude pier of the present season was built 14·5 feet to the northward of it. Signals were exchanged between El Paso and Austin, on April 7, 8, 9, 10, and 11, and again, after interchange of observers, on April 16, 17, 18, 20, and 21, making the required number to complete the line. Magnetic observations were also observed at both stations by Assistant Smith.

On April 23 Assistant Sinclair received notice by telegraph that his wife was critically ill, and would probably not survive many hours, and immediately telegraphed for authority to leave the field and proceed to his home in Charlottesville, Va. This was granted, and as the time was close at hand when it would be necessary for him to resume work on the resurvey of the California and Nevada boundary line, Assistant G. R. Putnam was at once detailed to take his place on the longitude work. Mr. Putnam arrived at Austin on April 27, and meanwhile Assistant Smith had moved to Laredo, Tex., and was preparing the pier and observatory at that place. These preparations were completed by April 29, and the regular observations were begun the same night. Exchange signals were obtained between Austin and Laredo on April 29, May 1, 2, 6, and 7, and again, after the usual interchange of observers, on May 9, 10, 12, 14, and 17, thus completing the line. In addition to the observations pertaining to the longitude determination, a full set of magnetic observations for declination, dip and intensity was made at each of these stations by Assistant Smith, and gravity determinations were made at both by Assistant Putnam. These observations being made in the daytime did not interfere with or delay the regular work of the party. Latitude observations were also made at Laredo by Assistant Putnam. Mr. Putnam then moved his instruments and outfit to Galveston, Tex., and had that station ready for occupation by May 21, but owing to continuous unfavorable weather, signals were not exchanged with Austin until the 26th, and frequent interruptions from the same cause occurred after that date. The exchanges of signals between Austin and Galveston were finally obtained on the nights of May 26, 31, June 1, 2, and 3, and again, after interchange of observers, on June 5, 6, 12, 13, and 16. A full set of magnetic observations, declination, dip and intensity, was also made at Galveston by Assistant Smith, and gravity determinations by Assistant Putnam. Mr. Putnam also made a trigonometric connection of the longitude station at Galveston with prominent points in the city. In the gravity determination at Austin, two stations were occupied, one in the State capitol, and the other in the State University. Assistant Smith then moved to New Orleans, La., and had that station ready for use on June 21. Mr. Putnam remained at Austin, and exchanges of signals between the two stations were obtained on three nights, viz, June 23, 25, and 27, when work was temporarily suspended in consequence of the departure of Mr. Smith for Washington, his connection with the Survey ceasing on June 30. Assistant A. T. Mosman was then detailed to complete the programme of work laid out for the party, arriving at New Orleans on July 2. The remainder of the season's work, falling in a new fiscal year, will properly appear in the next annual report.

It may here be mentioned that while Assistant Sinclair was observing at the El Paso station, signals were also exchanged with the Mexican National Observatory at Tacubaya, near the City of Mexico, and also with the Palacio Observatory, in the City of Mexico. This was done at the request of the officials of the Tacubaya Observatory, for the purpose of obtaining an accurate connection of the longitude system of the two countries, equally valuable to both. A determination of the difference of longitude between Tacubaya and St. Louis, Mo. (Washington University), had been made some years before, but as the observers did not exchange stations the error due to personal equation was not eliminated, and its amount was unknown. In the present case the interchange of observers was also omitted, but Signor Camilo A. Gonzales, the Mexican observer, subsequently came to Washington and observed with Mr. Sinclair at the Coast and Geodetic Survey Observatory, and also at the United States Naval Observatory for personal equation, so that the necessary correction to the field observations can be made. Exchanges of signals between El Paso and Tacubaya took place on nine nights, viz, March 29, 30, April 1, 2, 6, 7, 8, 9, and 10, and on four of these nights exchanges of signals were made also with the Palacio Observatory, City of Mexico.

The field computation of the nine nights' observations gives a probable error of $\pm 0^{s}{\cdot}0087$ in the resulting difference of longtitude. This is a very good result, especially in view of the fact that the telegraph circuit was 1 408 miles in length, and that there were repeaters at two points in the line.

Determination of latitude at Laredo, Tex.—The latitude of the station at Laredo, occupied by the telegraphic longitude party in the regular course of their longitude work, was determined astronomically by Assistant G. R. Putnam, in May, 1895. Other stations determined incidentally in the same way will be noticed under their appropriate geographical headings.

Magnetic observations at various stations in the State of Texas.—The regular series of three days' observations of magnetic declination, dip and intensity were made at El Paso, Austin, Laredo, and Galveston during the months of May and June, 1895, by Assistant Edwin Smith, while occupying these stations in the regular course of the telegraphic longitude determinations, as noticed in another part of this report. These observations were merely incidental to the main work of the party, and were so arranged as not to interfere with or delay it.

Determination of relative gravity with half-second pendulums at various stations in Texas.—During the progress of the telegraphic longitude work in the Southwest, described under its proper heading in this report, the spare time of the party was utilized in making other observations. In this way gravity observations were made by Assistant G. R. Putnam at Laredo, Galveston, and at two stations in Austin during the months of May and June, 1895. The improved apparatus heretofore described was used for this work, and the usual method of observation was followed. The reference or base station, as in all relative gravity determinations, was the one located in the "pendulum room" in the basement of the Coast and Geodetic Survey Office at Washington, D. C., the pendulums being swung there usually at the beginning and end of each field season.

Completion of the reconnaissance for a scheme of triangulation along the Rio Grande, from El Paso, Tex., to the Gulf of Mexico.—As stated in the 1894 report, Assistant Stehman Forney, under instructions dated February 28, 1894, had resumed the reconnaissance along the Rio Grande, his stations being selected on both sides of the stream. During the season, which lasted until September 30, about 500 miles of the river were examined, and 61 points for the triangulation selected and marked. The area of country covered by the figures laid out is about 11 700 square miles, and a suitable site for a base line, 5 miles in length, was found about 7 miles east of Brownsville.

The country from Eagle Pass to Fort Ringgold is high and rolling, the ridges being of nearly the same elevation, parallel to each other, and approximately at right angles to the general course of the river. The hills alternately approach and recede from the shores, and the descent to the alluvial plain, which varies in width from a few hundred feet to several miles, is usually very abrupt. A dense growth of mesquite brush and cactus extends to the river banks. On the Mexican side of the river the hills and ridges are higher, but the general character of the country is the same. Numerous creeks, dry or nearly so in summer, wend their way to the river, frequently forming deep gulches. From Fort Ringgold to the mouth of the river, a distance of 140 miles, the country is flat and slopes gently to the Gulf. The same dense growth of mesquite and cactus continues, and this section presented the greatest difficulties to the reconnaissance, and will involve considerable expense in the execution of the triangulation. Many of the stations will require tripods and observing scaffolds from 25 to 75 feet in height, and, owing to the hazy state of the atmosphere at all seasons of the year, the use of heliotropes will be necessary, or the observations will have to be made by means of night signals, as suggested by Mr. Forney in a previous report. The country from Eagle Pass to Brownsville was suffering from a protracted drought, but during August and September copious rains fell, causing the river to overflow its banks, and in a short time the narrow, sluggish stream became a wide and rapid torrent. Such freshets produce great changes in the bed of the river, which frequently shifts it position by considerable distances, so that it will probably be impracticable to trace the channel as it existed in 1848, at the time of the signing of the Guadalupe Hidalgo treaty. The portion of the river below Rio Grande City will present some difficult questions for the Boundary Commission to adjust and settle.

The low, marshy regions near the mouth of the river are frequently entirely covered with water, salt during easterly storms and fresh during river freshets. The prospect of a good harbor at the mouth of the Rio Grande is very slight, the bar being very shallow and frequently shifting its

position. Under the most favorable conditions 11 feet of water is on the bar at Brazos de Santiago, but here also the depth and position vary with every gale. The Morgan Line runs a steamer from Morgan City, La., to Brazos de Santiago once every ten days during the spring and summer months, but later in the season the trips are irregular and uncertain, as ten to fifteen days are sometimes lost in waiting for an opportunity to reach the anchorage inside the bar. From this point passengers and freight are carried by lighters to the wharf at Point Isabel and thence by a narrow gauge railroad to Brownsville.

The Laguna de la Madre, which flows into the Gulf of Mexico at Brazos de Santiago, extends to the northward the entire length of Padre Island to Corpus Christi, but is navigable only for small boats.

The triangulation from El Paso to the mouth of the Rio Grande should be taken up and pushed to completion at the earliest opportunity, but with the present very restricted appropriations this work will require a number of years.

The reconnaissance was completed on the 30th of September and the party disbanded. Assistant Forney was then granted a month's leave of absence, on the expiration of which he returned to Washington and completed the records and sketches of his season's work. He was then assigned to temporary office duty, first in the drawing division and then in the tidal division. Subsequently he was directed to organize a party to participate in the topographical resurvey of Buzzards Bay, Mass., as already noticed in a previous part of this report.

Magnetic records continued at the magnetic observatory near San Antonio, Tex., by means of the self-recording Adie Magnetographs, and absolute values determined monthly by means of portable instruments.—The magnetic observatory at Hillside Ranch, near San Antonio, Tex., continued under the charge of L. G. Schultz, and the instrumental outfit was the same as described in previous reports. Mr. Schultz personally attended to the magnetographs and made the monthly determinations of absolute values—in short, attended to all the actual observations—while Assistant R. E. Halter assisted in the computations and prepared the records for transmission to the office.

Complete photographic records from the three magnetographs were obtained from the beginning of the fiscal year to March 8, 1895, excepting July 4 and 5, when twenty hours' record of the vertical force was lost through a defective adjustment of focus, and on January 25, when the breaking of a cylinder clamp caused the stoppage of the driving clock for an hour and a half.

The scale coefficients (κ), representing the change of magnetic force corresponding to a change of one scale division, were redetermined twice during the year for the horizontal force and vertical force instruments; during July and March for the former and November and March for the latter. These values remained very constant throughout the whole period, a few units in the sixth decimal place covering the extreme range. The March determinations were made in consequence of instructions to discontinue and close the observatory about April 1, as the reduction of the appropriations rendered its further continuance impracticable.

From July 1 to October 1 the photographic sheets were changed every fourth day, each sheet thus containing four days' record, and for the remainder of the time every second day.

The statistics relating to the magnetograph records are as follows:

Number of photographic sheets developed	342
Number of scale readings observed	1 644
Number of trace readings of declination	6 576
Number of trace readings of horizontal force	6 576
Number of trace readings of vertical force	6 556
Number of trace readings of thermograph	6 576
Number of temperature observations	1 644

This tabulation refers to the routine work and does not include the large number of observations and readings made in determining scale coefficients and other instrumental constants.

At the request of the Chief of the Weather Bureau, and by direction of the Superintendent, special reports were made to the former every second day from October to March, these reports including, besides the records of the magnetographs, numerous copies of photographic traces, and a special record of trace readings for the determination of the times and extent of magnetic variations during meteorological disturbances within the United States.

Absolute determinations of the magnetic elements, declination, dip and intensity were made on five days of each month during the whole period, but the March observations were omitted in consequence of the loss of the magnetometer by robbery on March 9. The instrument was afterwards recovered, but not in season to obtain the observations. The instrumental constants were carefully determined and frequently checked, and all observations for the determination of force, both oscillations and deflections, were made in the afternoon when the temperature was most steady. Declination observations were always made in both morning and afternoon hours, and the dip only in the afternoon, and time observations for the rating of the observatory chronometer were made once a month.

The following is a tabulation of the observations, etc., made in connection with the absolute determinations:

	Observations.	Determinations.
Declination	800	40
Oscillations	640	40
Deflections	800	80
Dip	3 860	80
Time	192	8
Temperature	440	

The earth-current observations were discontinued early in the fiscal year, as it was found that the results were vitiated by the too near proximity of the electric car lines of San Antonio. During a few days in July, however, Mr. Schultz was authorized to conduct experiments at Rockport, Tex., but these were without definite result, as abnormal weather conditions prevailed during their continuance.

The observatory was finally abandoned on April 17, and Mr. Schultz returned to Washington, where he was engaged until the close of the fiscal year in completing his reductions and computations.

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

WESTERN DIVISION.

STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC.

40. California.
41. Oregon.
42. Washington.
43. Idaho.
44. Montana.
45. Wyoming.
46. Nevada.
47. Utah Territory.
48. Colorado.
49. Arizona Territory.
50. New Mexico Territory.

Progress Sketches Nos. 2, 4, 11, 12, and 5, 6, 7, 16, show the localities of field work in the Western Division. A list of Progress Sketches is given at the close of this volume.

Topographical resurvey of San Francisco Bay and Harbor.—At the close of the last fiscal year the party under the charge of Assistant A. F. Rodgers was already in the field engaged in preparatory work for the topographical resurvey of San Francisco Bay and Harbor. On July 9 the observing of horizontal angles on the supplemental triangulation was begun at Candlestick Point and continued to Point San Bruno. The new points were computed, abstracted, and platted on a projection, scale of 1–10 000, and the topographical work was then taken up from Point Avisadero southward. A second sheet was then laid out from Belle Air Island southward, but it was then found that owing to the disappearance of many of the points of the old triangulation, executed nearly forty years ago, it would be necessary to determine a large number of new positions. Authority for executing this additional work having been obtained, Assistant Rodgers erected the necessary signals and began the extension of the triangulation October 24. Much delay was occasioned at times by bad weather, and especially by the smoky condition of the atmosphere, and some of the longer lines had to be postponed to a more favorable season of the year. The party was engaged alternately on triangulation and topography until December 31, when on account of unfavorable weather conditions the party was temporarily disbanded. Assistant Rodgers proceeded to San Francisco and utilized the time in completing his records and computations. In the latter part of February the party was reorganized and field operations were resumed and continued to the close of the fiscal year. Assistant Rodgers was called upon from time to time by the hydrographic parties engaged on the resurvey of the bay for additional points, and these were in all cases furnished as promptly as circumstances would permit.

The statistics of the season's work are given by Assistant Rodgers as follows:

Number of triangulation stations occupied	36
Number of points determined trigonometrically	180
Number of pointings made in observing	2 670
Area covered by triangulation, in square statute miles	135
Area of topography survey, in square statute miles	38
Number of miles of shore line surveyed	35
Number of miles of creeks surveyed	11
Number of miles of roads surveyed	57
Number of miles of railroad surveyed	39
Number of topographic sheets completed	3

Hydrographic resurvey of San Francisco Bay and Entrance.—For the execution of this important work two parties, on the steamers *Gedney* and *McArthur*, respectively, were detailed.

The steamer *Gedney*, under the command of Lieut. Lucian Flynne, after completing the season's work in Washington Sound and Strait of Juan de Fuca, proceeded, in accordance with instructions, to San Francisco, arriving there November 9, 1894. After repairing and refitting at Oakland, Cal., the hydrographic work was commenced March 29, 1895, and continued to the close of the fiscal year.

The statistics of the work accomplished by June 30 are as follows:

Area sounded, in square geographical miles	10
Number of miles run while sounding	374·8
Number of angles measured	6 585
Number of soundings taken	12 383
Number of tidal stations established	3

The sheet upon which the party was engaged embraces that portion of San Francisco Bay from Alcatraz Island to Fort Point, including Richardsons Bay and Raccoon Straits.

The steamer *McArthur*, under the command of Lieut. James H. Sears, proceeded to San Francisco, Cal., after the close of the season's work on the west coast of Washington, and after the completion of necessary repairs, began work in the Bonita Channel and northern part of the Golden Gate February 1, 1895. Work was continued without interruption to the close of the fiscal year.

The statistics to the date of this report, June 30, are as follows:

Area sounded, in square geographical miles	25·4
Number of miles (geographical) run while sounding	903
Number of angles measured	15 185
Number of soundings taken	55 450
Number of tidal stations established	7

Both parties are still engaged upon this work, and the full statement of statistics and results will appear in the next annual report.

Continuation of tidal record at the Sausalito (San Francisco Bay) tidal station.—The self-registering tide gauge at the Sausalito tidal station, under the immediate charge of observer Emmet Gray, and under the supervision of Assistant George Davidson, continued in operation during the entire fiscal year, and furnished an unbroken record. The relation of the gauge to the permanent bench marks in the vicinity has been frequently verified, and the station chronometer has been rated and corrected by means of time observations at Lafayette Park observatory.

In connection with the hydrographic resurvey of San Francisco Bay and Harbor, another self-registering gauge has been set up at the wharf of the Union Iron Works at San Francisco, and placed in charge of the Coast and Geodetic Survey suboffice. Observations at this station will be maintained only during the continuance of the survey, but the low-water readings of both gauges will be corrected by a line of levels.

Longitude determinations by exchanges of telegraphic signals at stations in California and New Mexico.—For the account of this work, under the charge of Assistant C. H. Sinclair, see Middle Division, where the California and New Mexico stations, Needles and Santa Fe, are treated in connection with those of Texas and Louisiana.

Determination of latitude at Needles, Cal.—In February, 1895, Assistant C. H. Sinclair, in charge of the party engaged in determining telegraphic differences of longitude at various stations in the southwestern part of the United States, incidentally determined astronomically the latitude of the station at Needles, Cal. The station is located in the grounds of the Catholic Church, a short distance (about 50 inches) west of the pier used in the longitude determination. Zenith Telescope No. 6 was used and 71 observations were made on five nights, using fifteen pairs of stars. Other latitudes determined in connection with the longitude work will be noticed under their appropriate geographical headings.

Magnetic observations in California and New Mexico.—A full series of three days' observations for the determination of the magnetic elements, dip, declination, and intensity were made at Needles, Cal., and Santa Fe, N. Mex., by Assistant Edwin Smith during February and March, 1895. The observations were made incidentally, while the stations were being occupied for the determination of longitude, as already noticed in the account of the telegraphic longitude work, and being made in the daytime did not delay or interfere with the regular work of the party.

Magnetic observations at Carson City, Nev., and at Lake Tahoe, California.—In November, 1894, magnetic observations, declination, dip and intensity were made at Carson City, Nev., and Lake Tahoe, California, by the party engaged under the direction of Assistant C. H. Sinclair on the survey of the California and Nevada oblique boundary line. This was done at the close of the season and while the storing of the camp outfit, etc., was in progress, as stated in the account of the boundary survey work.

The station at Carson City was located in the grounds of the Pardion and in the meridian of the transit of Mr. C. W. Friend's observatory, and one square south of it.

The station at Lake Tahoe was located 25 metres due south of the longitude pier of 1893, near the Lakeside Tavern at the southeast end of the lake. Both stations are so marked that they can be recovered when necessary in the future.

Magnetic observations in the States of Washington and Oregon.—During the autumn and winter of 1894–95, Assistant J. J. Gilbert was instructed to redetermine the magnetic elements at various points in the States of Washington and Oregon. The first observations were made at Port Townsend, Wash., between the 13th and 21st of November. The old magnetic station was occupied, but on account of local disturbances the period of observation was extended several days beyond the usual time. Observations for magnetic declination, dip and intensity were next made at Olympia, Wash., during four days, viz, December 12, 13, 14, and 15. On February 12, Assistant Gilbert proceeded to Seattle and Tacoma, where dip only was required, one day being spent in observations at each place.

On February 18 Mr. Gilbert proceeded to Portland, Oreg., and made a full series of observations during three days, viz, February 20, 21, and 22, at the old magnetic station in the grounds of the United States custom-house. The observations at this station subsequently proved unsatisfactory, and it was found that the close proximity of the electric wires and other disturbing causes had vitiated the results. It was necessary, therefore, to select a new station free from such local disturbances, and this was done later in the season by Mr. Gilbert, who revisited Portland for that purpose in March, 1895. The new station, with the consent of the local authorities, was located in the city park, and observations for declination, dip and intensity were obtained on March 6, 7, and 8. On February 24, 25, 26, and 27 similar observations were made at Cape Disappointment, the old magnetic station near the house of the light keeper being reoccupied; and on March 1, 2, 3, and 4 at Vancouver, Wash. At Vancouver the old magnetic station of the Coast and Geodetic Survey could not be recovered, and a new one was therefore selected and carefully marked for future reference. The chronometer used in the magnetic work was rated by means of time signals telegraphed from the Lick Observatory.

Continuation of the hydrographic survey of the Strait of Juan de Fuca and Washington Sound, Washington.—As already stated, the steamer *Gedney*, under the command of Lieut. Lucian Flynne, was placed at the disposal of Assistant J. J. Gilbert, and the commanding officer directed to furnish every facility for the prosecution of the triangulation and topography; also, as opportunity afforded, to make a hydrographic survey of Washington Sound in the vicinity of San Juan, Orcas, and Stuart islands, and of the Strait of Juan de Fuca from the vicinity of Port Angeles to Whidby Island.

The hydrography is embraced on seven sheets, two of which relate to the Strait of Juan de Fuca and the remainder to Washington Sound. The shore line and geographical positions needed were furnished by Assistant Gilbert as his work progressed.

The party of Lieutenant Flynne collected much valuable information in relation to the harbors, channels, and dangers of this part of the coast, which will be utilized in the preparation of charts and in the Coast Pilot publications of the Coast and Geodetic Survey.

The *Gedney* arrived on the working ground May 19, 1894, and worked continuously until October 18, when, Assistant Gilbert's work being also completed, she proceeded to Port Townsend, and thence to Seattle, where certain necessary repairs were made. She then proceeded to San Francisco, arriving there November 9. After repairing and refitting at Oakland the vessel, still under the command of Lieutenant Flynne, was assigned to duty in connection with the resurvey of San Francisco Bay, as already noticed.

The statistics of the season's hydrographic work in Washington Sound and Strait of Juan de Fuca are as follows:

Area sounded, in square geographical miles	475
Number of miles (geographical) of sounding lines	1 233·5
Number of angles measured	10 145
Number of soundings taken	11 665
Number of tidal stations established	3
Number of specimens of bottom preserved	18
Number of hydrographic sheets finished	6

The list of naval officers attached to the hydrographic party of the steamer *Gedney* is as follows:

Lieut. Lucian Flynne, commanding officer; Lieut. L. J. Clark; F. C. Schubert, pay yeoman and draftsman; A. F. Berryhill, apothecary and observer; P. N. Christiansen, observer; and A. E. Brisman, recorder.

Continuation of the survey of Washington Sound, Washington, triangulation and topography.—In accordance with instructions of May 14, 1894, Assistant J. J. Gilbert had taken the field prior to the close of the last fiscal year, and the steamer *Gedney*, under command of Lieut. Lucian Flynne, was placed at his disposal. Lieutenant Flynne was directed to furnish every facility for the prosecution of the work of Mr. Gilbert, and, as opportunity offered, to execute the hydrography. Assistant Gilbert joined the *Gedney* at Port Townsend on the 18th of May, and as soon as the necessary supplies were obtained the vessel proceeded to Friday Harbor. The erection of signals was at once begun, and, during the remainder of May, 65 were completed along and near the shores of Haro Strait. Triangulation observations were begun June 1 and completed July 27, during which time the triangulation was extended through Haro Strait, President Channel, Middle Channel, Harney Channel, and West Sound, including Deer Harbor, Mosquito Pass, Rock Harbor, and Westcott Bay. The balance of July was occupied in making projections for the topographic sheets. The topography was begun August 1 and closed October 17, during which interval three sheets were completed.

Owing to the requirements of the hydrography, the triangulation was extended far beyond the limits necessary for the season's topography, and by working every night Assistant Gilbert was able to keep up the computations and furnish geographical positions to the hydrographic party without any delay to either class of field work.

The statistics of the season's work are as follows:

Area of triangulation, in square statute miles	215
Number of signals erected	142
Number of stations occupied	93
Number of geographical positions determined	146
Area of topography, in square statute miles	36·6
Length of general coast line surveyed, in statute miles	96·8
Length of roads surveyed, in statute miles	51·3
Number of topographic sheets completed	3

The topography executed includes the northwest part of Orcas Island, and San Juan Island from the middle of the Spieden Channel to Dead-Mans Bay, and the following complete islands: Shipjack, Bare, Waldron, Gull, Flattop, Stuart, Johns, Cactus, Spieden, Henry, Morse, and Barren.

After closing the work, Assistant Gilbert proceeded on the *Gedney* to Port Townsend, where he stored his instruments, and thence to Seattle, where he left the vessel and proceeded to Olympia for the completion of his office work.

Subsequently he was directed to make certain magnetic observations in Washington and Oregon, which will be noticed in the proper place.

In his report Assistant Gilbert expresses his high appreciation of the uniform courtesy of Lieutenant Flynne and the other officers of the *Gedney*, and the zeal displayed in the prosecution of the work.

Hydrography off the coast of Washington.—At the close of the previous fiscal year the steamer *McArthur*, under the command of Lieut. F. H. Crosby, U. S. N., was engaged in making a hydrographic survey of the coast of Washington, from Grays Harbor to the Quillayute River.

On the 18th of August, while attempting to land through the surf near the mouth of Jo Creek, for the purpose of building a signal, the whaleboat, containing the commanding officer and nine men, was capsized, and Lieutenant Crosby and four seamen were drowned. This distressing accident was reported by Ensign C. P. Eaton, upon whom the command of the vessel temporarily devolved, as follows:

STEAMER MCARTHUR,
Ocosta, Grays Harbor, Washington, August 20, 1894.

SIR: It is my painful duty to report the death by drowning of Lieut. F. H. Crosby, Quartermaster Third Class John Freyer, and Seamen William Nehm, Alexander Smith, and Jens Gudmundsen, while attempting to land through the surf near Jo Creek, about 17 miles north of Grays Harbor, on the west coast of Washington, about 8 a. m., Saturday, August 18.

The *McArthur* anchored about a mile and a half offshore at this point Friday afternoon. That afternoon Lieutenant Crosby, the commanding officer, with nine men, landed through the surf, and commenced to erect a hydrographic signal. At this time the sea was smooth, with hardly any swell. Saturday morning there was a dense fog and long swell. Lieutenant Crosby left the ship, with nine men, on the whaleboat at 7·20, to complete the signal. When outside the surf he directed the men to take off their shoes and heavy clothing, cast off the trailing lines of the oars, unship rudder and steer with an oar. He cautioned them that a boat might go through the surf with safety ninety-nine times and be capsized on the hundredth; he then cautioned them if upset to get hold of life-preservers or oars, dive under the breakers and come up between them to breathe, and make for the beach. They then pulled a few strokes toward the beach, when a big breaker caught the boat and swung her to starboard, nearly broadside to the surf. Before they could turn the boat another breaker caught and capsized her. After a hard struggle, five men, Erik Carlson, quartermaster, second class; Seamen Jan Rask, Charles Hagerstrom, and M. Becker, and First-Class Fireman O. Danielson succeeded in getting ashore, most of them in a dazed and exhausted condition. They were cared for by the settlers along the beach. As soon as sufficiently revived, they and a number of settlers patrolled the beach, searching for the others. The whaleboat was washed ashore about one mile below where most of the survivors landed. There are white settlers every mile or so along the beach, and both white men and Indians are constantly traveling back and forth, but the fog was so thick that morning that one could see only 40 or 50 yards, and the settlers first knew of the accident by the survivors of the whaleboat going to their houses.

About 11 a. m. the fog began to clear. I had a lookout kept from the ship, and watched constantly myself with the glasses for the captain and party. I saw no signs of them at work on the signal, and feared an accident had happened, especially as the surf was very heavy. I ran in as close to the shore with the ship as was safe, and after a while saw a man waving a tablecloth as a signal. Knowing that I could do nothing from outside with the ship or boats, I ran inside Grays Harbor and anchored near Damons Point. On the way down I kept a careful lookout for any signs of the party, knowing that there was a strong inshore current to the southward. I felt that nothing could be done by us under the circumstances, however, as such a long time—over three hours—had elapsed since the whaleboat must have entered the surf. Immediately upon arrival at Damons Point I secured a team and drove up the beach to the scene of the disaster, and found that five men had reached the beach in safety. They patrolled the beach until 2 p. m., and then returned to the ship. The settlers patrolled the beach that day until dark, and all the next day. They did all in their power to render assistance. The whaleboat, oars, etc., were washed ashore, but no bodies have been found up to this time.

Mrs. Crosby, who has been living in Ocosta this summer, has been notified.

I gathered the tools, gear, etc., they had ashore, and engaged a wagon to bring the whaleboat down to the Oyehut, where I can get it, and knowing I could do no further good, started back for the ship. On the way down our team ran away while crossing a bridge over swampy land, and Roscoe, the apothecary, the driver, and myself were thrown out. Roscoe had a bad hole made in front of his left leg above the ankle, reaching to the bone, and from his complaints I feared he had suffered internal injuries also.

I got another team, and, as soon as we got back to the ship, came to Ocosta. Fortunately, the doctor says Roscoe's injuries are not serious, but the hole in his leg will lay him up for several weeks, probably. I escaped with a sprained hand and leg and bruised head, and will probably be all right in three or four days.

A little steamer makes daily trips to the Oyehut from Ocosta, and the settlers along the beach will keep me informed as to whether any bodies are found. I expect to go to the Oyehut after the whaleboat in a few days, if able, or will have it and the gear brought over by the steamer. I directed that they be left in the care of the storekeeper at the Oyehut.

From the accounts of the settlers the bodies may be washed ashore in from three to ten days, or not at all.

The safe is locked and the combination unknown on board, so I can not ascertain the state of the accounts of Lieutenant Crosby, and of the men. I respectfully request instructions under the circumstances, and as to entries to be made on enlistment records, etc.

Respectfully,

C. P. EATON,
Ensign U. S. N., Commanding.

To Lieut. Commander J. F. MOSER, U. S. N.,
Hydrographic Inspector.

The bodies of Lieutenant Crosby and three of the men were subsequently washed ashore at various dates; that of Lieutenant Crosby on September 28, or about six weeks after the accident.

By this sad mishap the Survey and the Navy lost a valuable and efficient officer. Some account of his services will be given in the report of the hydrographic inspector in the "Office Report No. 2" of this volume.

Lieut. James H. Sears was assigned to the command of the *McArthur*, and reported on board September 3. The season's work closed a few days later, September 10.

The following are statistics of work accomplished during the season:

Area sounded, in square geographical miles	773
Number of miles run while sounding	1 177·5
Number of angles measured	6 683
Number of soundings	22 001
Number of tidal stations established	1
Number of current stations	22
Number of hydrographic sheets finished	2

The *McArthur* then proceeded to San Francisco, Cal., to assist in the resurvey of San Francisco Bay, as already noticed in the proper place.

Examination of depths of the water front of Tacoma, Wash.—In consequence of the landslide which occurred at Tacoma in November last, and in response to numerous requests, it was deemed advisable to make an examination of the depths near the water front, and as the steamer *Hassler* was laid up in the vicinity, the commanding officer, Lieut. G. B. Harber, was directed to make the survey.

The results have been platted and show that considerable changes have taken place.

The statistics of the work are as follows:

Number of miles (geographical) of sounding lines	12·8
Number of angles measured	394
Number of soundings taken	438
Number of tidal stations established	1
Area sounded, in square geographical miles	0·25

Determination of relative gravity with half-second pendulums in Colorado, Wyoming, and Utah.—Gravity determinations with the new half-second pendulums were made at various stations in these States and Territories by the party under the charge of Assistant G. R. Putnam during the months of July, August, and September, 1894.

The stations in Colorado were located at Denver, Colorado Springs, Pikes Peak, Gunnison, and Grand Junction; those in Wyoming at Grand Canyon, Norris Geyser Basin, and Lower Geyser Basin (all in the Yellowstone Park); and those in Utah at Salt Lake City, Green River, and Pleasant Valley Junction. These stations form part of the transcontinental series already mentioned and described in the general account of the season's gravity work under the head of "The Eastern Division." For further particulars, see pages 28 et seq. of this volume, and Assistant Putnam's paper, published as Appendix No. I, in Part II of the Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year 1894.

It may here be mentioned that the localities of the stations at Pikes Peak and Colorado Springs were selected with a view to obtaining, incidentally, data for the determination of the mean density of the earth. The observations have been computed by Mr. Putnam, and give 5·63 as the value of the earth's mean density.

Laying out a meridian line at Colorado Springs, Colo.—In August, 1894, Assistant G. R. Putnam, while occupying the station at Colorado Springs for the determination of gravity, laid out, at the request of Prof. F. H. Loud, a true meridian line, for the use of local surveyors in testing their compass needles and determining the magnetic declination.

Geodetic work.—Continuation of the transcontinental triangulation in Colorado.—At the close of the last fiscal year the party under the charge of Assistant William Eimbeck had completed the reconnaissance eastward from Mount Ouray and was engaged in transporting camp and outfit up that mountain and making the preliminary arrangements for its occupation. Mount Ouray is one of the main stations of the great transcontinental triangulation, is located on the axial line of the Continental Divide, and rises to an altitude of 14 100 feet. The work at this station comprised all the classes of geodetic, astronomical, and magnetic observations usually made at primary points in the mountain region, and these observations, particularly those for horizontal

directions, were extended over a sufficient interval of time to include varied meteorological conditions, and thus secure results reasonably free from the vitiating effects of atmospheric refraction.

Eight primary and many secondary points were observed upon for horizontal directions, heliotropes being used on all the primary lines, and zenith distances for the determination of relative elevations were also observed on both primary and secondary points. The astronomical work consisted of time, latitude, and azimuth determinations, and the magnetic work of the usual observations for declination, dip and intensity. The occupation of the station was completed early in August, after which a short base was measured at the lower camp by means of a steel tape, and a local triangulation was executed to connect the railroad station at Marshall Pass, and differences of elevation were carried through the scheme by means of zenith distance measures. A bench mark was established at Marshall Pass, so that the spirit-leveling work of the survey may ultimately connect with the points determined trigonometrically. A similar trigonometrical connection, for the same purpose, was effected the preceding spring at Grand Junction. While the occupation of Mount Ouray was in progress, three cooperating parties, under Mr. Eimbeck's general direction, simultaneously occupied the stations at Mount Elbert, Bison Peak, and Plateau. The special notice of the work of these parties will appear farther on.

Assistant Eimbeck, in accordance with instructions, closed field operations on the 31st of August, and disbanded his party at Gunnison, Colo., and the cooperating parties were also directed to suspend work about the same time. Aid R. L. Faris and Recorder A. C. Walker, attached to Assistant Eimbeck's immediate party, returned to Washington early in September, and were temporarily employed at the office on the records and computations. Assistant Eimbeck, after settling up his party affairs, also returned to Washington by September 20, and was engaged during the winter in completing his records, making the necessary computations, abstracting results, etc. Aid R. L. Faris was detached from the party on January 4 and assigned to duty in the party of Assistant P. A. Welker, in Pensacola Bay, Florida., as mentioned elsewhere in this report.

In the spring of 1895 the field work in Colorado was resumed, and Assistant Eimbeck reorganized his party at Grand Junction early in May, Assistant John Nelson, Aid R. L. Faris, and Recorder Willis M. Baum and Walter H. Clay reporting to him for duty at that place. For the work in the vicinity of Grand Junction the party was divided, Assistant Eimbeck, with W. H. Clay as recorder, taking charge of the occupation of "Chiquita" station, while Messrs. Nelson and Faris, with W. M. Baum as recorder, executed the trigonometric connection of the Grand Junction astronomical station with the main triangulation. Both of these operations, in spite of unfavorable weather conditions, were completed by June 6, when the two branches of the party were consolidated for the main work of the season which involved the occupation of Treasury Peak, Pikes Peak, and Uncompahgre. The party was transferred first to Gunnison and thence to the Elk Mountains, and on the 16th of June went into camp at State Creek Canyon, about 4 000 feet below the summit of Treasury Peak. Here considerable delay was occasioned by the fact that the snow was yet deep, the former camping ground of 1893 near the summit being still buried under an extensive snowdrift 15 feet deep. Assistant Nelson was detailed to prepare the Pikes Peak station for occupation and the same condition of affairs was found to exist there, and similar difficulties were also encountered in stationing the heliotropers at Mount Elbert and Mount Ouray. In addition to these obstacles to progress, the party had to contend also, during the latter part of June, with severe and boisterous weather, snowstorms occurring almost daily, and the temperature being very low. The instruments were mounted by the 23d of June, but at the close of the fiscal year little progress had been made in the observations at either station, although the preparatory work was all completed.

Incidental to the main work at Grand Junction a line of spirit levels was run from the trigonometric station to connect with the railroad levels at the Denver and Rio Grande depot, and certain gravimetric observations were made with a view to determining later the relative gravity intensity at the summit of Uncompahgre. Magnetic observations, declination, dip, and intensity were also made at "Chiquita" station.

Assistant Eimbeck, in his report, highly commends Assistant John Nelson, Aid R. L. Faris, and the recorders of the party for their untiring diligence and painstaking devotion to the interests of the work, and the creditable discharge of the arduous duties devolving upon them.

The party being still in the field, the results of the season's work will appear in the next annual report.

Geodetic work.—Continuation of the transcontinental triangulation in Colorado.—At the beginning of the fiscal year Assistant F. D. Granger was assigned to duty on the transcontinental triangulation in Colorado, and proceeded to Pueblo early in July and organized a party for the occupation of Plateau, a station in the main scheme previously selected by Assistant William Eimbeck, and located about 9 miles to the northeast of Pueblo. The station was prepared and in readiness for observations by the 18th of July, but owing to unfavorable weather conditions they were not begun until the 22d. Three primary and twenty tertiary objects, mostly mountain peaks, were here observed for horizontal directions, and double zenith distances of all the primary and most of the tertiary points were also determined. The three primaries observed were Pikes Peak, Mount Ouray, and Mount Bison, and a fourth—Cramers Gulch—was also desired, but the line to it was found impracticable on account of high intervening ridges. Observations at Plateau were completed by August 14, and the station was then carefully marked and described, and a target-tripod signal was then erected over it. Preparations were then made for the transfer of the party and outfit to Big Springs, but the nonarrival of funds caused a delay until the 20th, when telegraphic orders were received to close field operations and disband party, the balance of appropriation remaining not being sufficient for the occupation of another station. The camp outfit, instruments, etc., were moved to Pueblo and stored by the 27th, when the party was disbanded, and Assistant Granger returned to Washington, accompanied by his recorder, C. K. Knight, who rendered valuable service during the season.

Assistant Granger, after computing the results of his field work, was assigned to duty in the office until May 16, 1895, when he was directed to prepare for the resumption of field work on the transcontinental triangulation early in June. Leaving the East on June 2 he arrived at Pueblo on the 5th, and by the 14th the party was organized and en route to Big Springs, distant from Pueblo by wagon road about 50 miles. The station was prepared for observations, heliotropes being posted at Plateau, Pikes Peak, and Divide, and the work was fairly under way before the close of the fiscal year. A reconnaissance was also made for the location of a secondary station between Big Springs and Plateau, the line from the latter to Cramers Gulch having proved impracticable, and the point Dry Camp was selected.

The observations at Big Springs will determine the horizontal directions and the elevations of four primary, one secondary, and a number of tertiary points, and the usual determinations of magnetic declination will be made. The primary stations are Cramers Gulch, Plateau, Pikes Peak, and Divide, and the secondary station is the newly selected one at Dry Camp. Mr. J. B. Boutelle, a computer in the office, was detailed to act as recorder and to assist in the observations, and Mr. E. E. Torrey was assigned to the party as foreman; and Assistant Granger, in his report, highly commends both for their efficient services rendered in the prosecution of the work.

Mr. Granger's report for the fiscal year is accompanied by a sketch showing the relative positions and distances of the primary and secondary points, the distances observed ranging from 20 to 90 miles.

The principal statistics of the party's work for the year have been tabulated as follows:

Area of triangulation, in square statute miles	1 130
Number of signals erected	6
Number of stations occupied for horizontal measures	2
Number of stations occupied for vertical measures	2
Number of geographical positions determined	6
Number of elevations determined trigonometrically	6
Number of magnetic declinations determined	1
Number of new stations selected	1
Number of primary stations observed for horizontal directions	7
Number of secondary stations observed for horizontal directions	1
Number of tertiary stations observed for horizontal directions	20

Continuation of the reconnaissance and transcontinental triangulation in Colorado.—As the result of the conference between the Superintendent and the chiefs of the four parties to be engaged on the Colorado section of the transcontinental triangulation, the reconnaissance and occupation of the

northeastern portion of the great figure which has Pikes Peak for its central point, the Continental Divide for its western limit, and includes to the eastward points in the scheme crossing the Colorado Plains, was assigned to Assistant F. W. Perkins, who took the field about the middle of June, 1894. The king peaks of the Saguache Range, Mount Ouray and Mount Elbert, had already been selected, Pikes Peak was known to be visible from both of them, and the valley of the Arkansas River makes an opening between the Arkansas Hills and the Wet Mountains, through which, from Mount Ouray, the plains had been seen past the northern end of the Sangre de Christo Range. On the north over a hundred miles of unpromising country lay between "Mount Elbert" and the northernmost plains station "Divide," and the Park Range, the Puma Hills, the Tarryall Mountains, and the Rampart Range crossing the line between these two points, it was feared that it might be impracticable, and that recourse would be necessary either to two extra intermediate stations, or to Mount Evans, 30 miles to the north, and known to be very difficult of access, especially to a party laden with instruments and camp outfit. To reconnoiter this country, settle questions of intervisibility, and project the most practicable scheme of connection, was the first duty of Mr. Perkins, after which he was to make the necessary observations at as many of the selected stations as time and available funds would permit.

Assistant Perkins reached Denver on the 11th of June, and immediately began preparations for the reconnaissance. Pikes Peak and Divide Station were first visited, and it was soon demonstrated that the line from the latter to Mount Elbert was impracticable owing to the great height of the intervening Rampart Range. A little to the northward of the line, however, a peak was visible which was identified as Bison, the highest peak of the Tarryall Mountains. This peak was reached after considerable difficulty, and from it Pikes Peak, Mount Evans, Mount Ouray, the Divide of the Arkansas and Platte, and Mount Elbert, were found to be visible, the latter just showing through a depression in the intervening Mosquito Range. Bison was therefore suitable for the connecting station, and further reconnaissance being unnecessary, Mr. Perkins returned to Pikes Peak to erect a signal and post a heliotrope, leaving his recorder, Frederick L. Olmsted, to cut the trail and prepare Bison Station for occupation. This was accomplished in due time, and observations were begun at Bison on the 15th of July, heliotrope signals having first been exchanged with all the stations to be observed, except Mount Elbert.

The observations were completed early in August in spite of very unfavorable weather conditions. Rain, hail, or snow fell nearly every afternoon, and consequently a large part of the observations were taken in the morning hours, but a sufficient number of afternoon measurements were obtained to verify the results. Mr. Olmstead was then sent to prepare the Pikes Peak Station, but owing to the nonarrival of funds the main party was delayed at Bison until August 23, and additional observations were made meanwhile. At that date instructions were received to close field operations and disband party, as the remaining funds would not suffice for the occupation of another station.

The moving of the party from the mountains, the collecting and storing the outfit and instruments, and final disbanding of party were accomplished by the 29th, and Assistant Perkins returned to Washington.

The statistics of the season's work are given as follows:

Number of new points selected for the scheme	1
Number of lines of intervisibility determined	4
Aggregate length of lines, in statute miles	212
Area of reconnaissance, in square statute miles	2 900
Number of stations occupied for horizontal and vertical measures	1
Number of signals erected	1
Number of observing piers erected	3
Number of directions determined	5
Number of observations for horizontal direction	3 420
Number of elevations determined trigonometrically	4
Number of observations for vertical angles	1 004
Number of magnetic declinations determined	1

The horizontal measures were made by Assistant F. W. Perkins, and the vertical and magnetic observations mainly by Recorder F. L. Olmsted.

Assistant Perkins has submitted a very full report concerning the country traversed by him in the reconnaissance and on his geodetic work. The report is also accompanied by a sketch showing the relative positions and distances of the main points of the scheme. The distances observed in the triangulation this season range from 36 to 70 miles.

His subsequent services on the oblique arc in Alabama have been mentioned elsewhere in this report.

Continuation of the transcontinental triangulation in the vicinity of the thirty-ninth parallel, in Colorado.—At the beginning of the fiscal year the party under the charge of Assistant P. A. Welker had reached the summit of Mount Elbert, a high peak of Lake County, Colo., and was nearly ready to begin observations. Mount Elbert is located on the Continental Divide, and has an altitude of about 14 436 feet, and is therefore the highest point ever occupied as a triangulation station. It is, moreover, one of the most difficult of access, and the difficulties encountered in making the ascent, establishing camp, and preparing the station were very great. The preliminary preparations were completed by July 8, and the observations were begun the following day. Owing to the peculiar weather conditions, the majority of the observations were made during the morning hours, there being rarely an opportunity for obtaining them in the afternoon on account of wind, snow, and thunder storms. Regarding the abnormal atmospheric conditions which prevailed during the occupancy of the station, Mr. Welker reports as follows:

> It would be difficult to describe the terrible experience of the party at this station. During my years of service in these mountains, I have never seen anything that could be compared to it. Every day during its occupation, with one exception, there were heavy snowstorms, accompanied by wind and the most terrific lightning and thunder that can be imagined. At times the mountain was charged with electricity, numerous suspended electric lights were seen, and different members of the party received violent shocks. The storms invariably continued from noon until about 9 o'clock at night. The observatory and theodolite were struck twice, the vertical circle twice, the azimuth mark once, and a rock cairn near the summit once. One bolt destroyed the brick pier of the theodolite, and plowed an 8-inch furrow about 15 yards long through the rocky surface of the summit. The sunshade at the end of the theodolite telescope was twice pierced by lightning, the molten metal spattering over the object glass and shattering it, and the Y's, pivots, and foot screws of the instrument were badly burned.

The damaged instrument was repaired as well as possible with the limited tools and facilities available, and the observations completed, after which it was returned to Washington for thorough repair.

Although the electric storms were unusually violent and continuous this season, it is an established fact that on the higher mountains they are always severe during the months of July and August, and the occupation of the summit should, as far as possible, be avoided during these months. Unfortunately the season when observations are practicable in these high altitudes is at best short, but September and October are usually very favorable.

All observations for horizontal directions were referred to a mark located on a sharp peak at a distance of about 2½ miles from the station. The observations were made in 16 positions of the theodolite circle, one observation with telescope erect, and one with telescope reversed being considered a series. The series in each position were necessarily much broken on account of all the objects not showing at the same time, but these were eventually all observed.

The work at the station consisted of observations for horizontal directions, vertical measures, and magnetic declination. For the horizontal and vertical observations heliotropes were stationed at five main points of the triangulation scheme, viz, at Ouray, Uncompahgre, Treasury, Bison, and Pikes Peak, and the same heliotropes were utilized for showing to the observers of the other parties simultaneously employed on the transcontinental geodetic work. Observations were also made upon 26 secondary peaks, and five prominent objects at Leadville and Twin Lakes were determined. The length of triangle sides in the main scheme ranged from 36 to 91 miles. The cupola of the Ninth street schoolhouse at Leadville was also occupied for the purpose of connecting the town with the main triangulation and determining positions of secondary points.

The observations at Mount Elbert were finished July 27, after which the work above mentioned was done, and preparations made for the occupation of Mount Uncompahgre, but before reaching the latter station the party was recalled, owing to the exhaustion of the appropriation, the amount having been reduced by the appropriation act which passed in August.

The party was disbanded August 30 after suitable provision had been made for the storage and care of the property.

Assistant John Nelson was attached to the party during the season, and made all the observations for vertical measures and magnetic declination, and his zeal and hearty cooperation are highly commended by Mr. Welker.

Messrs. Welker and Nelson, at the close of the season, returned to Washington, and were engaged on the reductions and computations of their field work until again assigned to other duty. Their further field services are mentioned under the appropriate headings elsewhere in this report.

Mr. Welker's report is accompanied by a sketch showing the work accomplished, and the connection of Mount Elbert with the other points of the great transcontinental triangulation.

The statistics of the season's work have been tabulated as follows:

Number of observations of horizontal direction	869
Number of observations for vertical measures	1 005
Number of determinations of magnetic declination	5
Number of points observed for horizontal direction	37
Number of points observed for vertical measures	13

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1895.

DIVISION OF ALASKA.

[Under this heading are included the coasts of Alaska which border on the North Pacific Ocean, on Bering Sea, and on the Arctic Ocean; also the inlets, sounds, bays, and rivers.]

The localities of field operations in Alaska are shown in Progress Sketches Nos. 3, 4, and 17 to 24, inclusive. See a list of Progress Sketches at the close of this volume.

Hydrographic and general surveys in Alaska.—The steamer *Patterson*, under the command of Lieut. Commander W. I. Moore, at the beginning of the fiscal year was engaged in the survey of Chatham Straits, Alaska, having previously landed the parties of Assistants Dickens, Morse, and McGrath at their respective stations at the head of Behm Canal, Sitka, and Yakutat Bay. She reached her working ground and began work on May 27. The work assigned for the season included the survey of Chatham Straits from Point Augusta to Point Samuel, the west end of Kenasnow Island and Freshwater Bay, Tenakee Inlet (Siwash Passage), and the north end of Hoods Bay, including Killisnoo Harbor. The triangulation, shore line, and hydrography were completed to Point Samuel, with the exception of Kootsnahoo Inlet, but part of the sketching of the topography was left unfinished, owing to the interruption of the work caused by the necessity of transporting the civilian parties engaged on the Alaskan Boundary Survey.

A base line of 1 950½ metres was measured on the north shore of Tenakee Inlet, and the triangulation was carried northward from it to connect with Lieutenant Commander Mansfield's work of 1890, and southward to Point Samuel.

During the progress of the work tide gauges were established at Funter Bay, Parlor Harbor (Nasanki), and Killisnoo, and astronomical stations were determined at East Point and at Angoon village, near Killisnoo.

The *Patterson* left the working ground on August 2 for Yakutat Bay, and proceeded thence with Assistant McGrath's party to Lituya Bay, returning to Chatham Straits August 14, but a topographical party was kept in the field during her absence. On August 14 the season's work closed, and Lieutenant Commander Moore proceeded with the vessel to Sitka to take on board Assistant Morse's party, and then returned to Port Townsend and San Francisco, arriving at the former place August 30 and at the latter September 7. The *Patterson* remained at San Francisco during the winter, and on March 15 Lieut. Commander W. I. Moore was relieved of the command of the vessel and was succeeded by Lieut. Commander E. K. Moore.

The following is a list of naval officers and others attached to the party during the season: Lieut. Commander W. I. Moore, commanding officer; Lieut. James H. Sears; Lieut. R. F. Lopez, astronomer; Lieut. Hugh Rodman; Ensign W. B. Hoggatt; Ensign Glennie Tarbox; P. A. Surg. C. J. Decker; Assistant Engineer H. G. Leopold; Draftsmen and Recorders H. L. Ford, W. G. Appleton, and H. Rodman.

The statistics of the season's work are tabulated as follows:

Number of base lines measured	1
Number of triangulation signals erected	44
Number of other signals erected	276
Number of stations at which angles were measured	291
Number of stations occupied for vertical measures	48
Number of latitude stations determined	2

Number of pairs of stars observed for latitude	41
Number of chronometric longitude stations	2
Number of azimuth stations	2
Area of topography sketched, in square statute miles	385
Length of shore line delineated, in statute miles	301
Number of topographic sheets worked on	3
Area sounded, in square geographic miles	320
Number of miles (geographic) run in sounding	830
Number of angles measured	4 143
Number of soundings taken	6 619
Number of tidal stations established	3
Number of specimens of bottom preserved	8
Number of hydrographic sheets completed	4

The resumption of work by the steamer *Patterson*, in the spring of 1895, will be mentioned in the next paragraph.

Resumption of hydrographic and general surveys in Alaska in the spring of 1895.—The steamer *Patterson*, under the command of Lieut. Commander E. K. Moore, was again fitted out in the spring of 1895 for the continuation of the hydrographic and general surveys in Alaska, and sailed from San Francisco on the 11th of April, touching at Seattle and Tacoma on the way. By direction of the Superintendent she was required to furnish transportation to the various civilian parties of the survey, to be engaged on the Alaskan Boundary Survey, to their respective fields of work, and Assistants E. F. Dickins and Fremont Morse, with two men and the outfit and stores for four field parties, accordingly joined the steamer at San Francisco, and Assistant P. A. Welker Aids O. B. French and C. C. Yates, and extra observers H. A. Grady and R. L. Livingston, with eight men and the remaining party equipments, were taken on board at Seattle. Assistant Morse was landed at Seattle, that being the base station for the determination of Alaskan chronometric longitudes, and the other parties were landed at Port Simpson, the head of Portland Canal and Mary's Island, respectively. The schooner *Earnest*, laden with coal for the season's consumption, was taken in tow at Tacoma and left at Port Simpson in temporary charge of the civilian parties, and the steam launch *Fuca* was delivered at the head of Portland Canal to Assistant P. A. Welker for the use of his party in the chronometric longitude work. The *Patterson* then proceeded to her own working ground, stopping on the way at Wrangell Narrows to locate an uncharted shoal reported by the *City of Topeka*, at Killisnoo to land signal lumber, and at Sitka to take on board the boats and equipments stored at the close of the previous season.

The regular field work of the season was begun May 13 in Chatham Straits at the point reached last autumn, and at the close of the fiscal year the party had made good progress. A tide gauge was established on the east face of the "Alaska Oil and Guano Company's" wharf at Killisnoo, and a base line 700 metres in length was measured at the mouth of Hootz or Hood Bay; this base, the longest that could be obtained in the locality, was connected with the triangulation of the previous season, making a satisfactory junction, and from it the triangulation was extended into Hootznahoo or Kootznahoo Inlet and across Chatham Straits into Peril Strait as far as Broad Island. The hydrography has been nearly completed within the same limits, but in certain localities some further development may be necessary; and the sketching of the topography has been carried down Chatham Strait on the west side as far as the north side of Peril Strait, and on the east side to Danger Point, including Hootznahoo Inlet. Hootznahoo Inlet is a dangerous sheet of water about 12 miles in length by 5 in width, filled with islands, rocks, reefs, and rapids, but there are channels through which vessels of moderate size can pass at slack water, and fair anchorage exists in its two principal bays. Coal has been found here, and some has been mined, and it was deemed advisable, therefore, to make a thorough local survey, and Ensign W. B. Hoggatt was left for six weeks with a detached party in camp for this purpose. Hootz Bay contains some rocks and reefs, but there is a good channel at the entrance, plenty of water inside, and a fair anchorage at the head. At present these two bays or inlets are used chiefly by the Alaska Oil and Guano Company, which has extensive works and a good wharf at Killisnoo, and runs a number of steamers, scows, and other boats. This company is well equipped, and is prepared to do a large business, but during the stay of the *Patterson* in the vicinity the works were closed in consequence of the prevailing "hard times."

An astronomical station was also established at Killisnoo, the longitude being obtained by chronometric exchanges with the Alaska Boundary Survey parties and the latitude by direct observation.

On June 25 the vessel moved to Pogibshi Anchorage, north of Pogibshi Point, at the west end of Peril Strait, and here a tide gauge was erected and sites selected for an observatory and an additional base line.

The north end of Peril Strait is a wide sheet of navigable water, deep to the shore line, but containing many outlying islands, rocks, and sunken reefs; the shores are abrupt, and the surrounding hills, like those in nearly all parts of southeastern Alaska, are high, rugged, and covered to a height of about 2 000 feet with a dense growth of timber. This region is within the limits of the fishing and hunting grounds of the Sitka Indians, and they are frequently met with in their canoes and temporary camps. Fish are plentiful, both in the straits and in the mountain streams, but game is becoming comparatively scarce, although some deer, bear, and grouse are still found. Vegetation is rank along the beach and in places reached by the rays of the sun, and blueberries, salmon berries, and wild flowers are abundant. More than thirty varieties of the latter were collected within an area of three or four acres at Pogibshi Point; among them, sweet peas, violets, columbines, flags, water lilies, and others known to warmer climates and more southern latitudes.

The weather during the season was favorable for the execution of triangulation and hydrography, but the topography and astronomical work were somewhat delayed by drizzling rains, low-hanging clouds, and fogs, the latter concealing the hill and mountain tops, but not interfering with sights on the lower levels.

The statistics to the close of the fiscal year are given by Lieutenant Commander Moore as follows:

Number of base lines measured	1
Area covered by triangulation, in square statute miles	140
Number of signal poles erected	742
Number of stations occupied for horizontal angles	546
Number of astronomical stations determined	1
Number of pairs of stars observed for latitude	30
Number of chronometric longitudes determined	1
Number of azimuths observed	1
Area of topography sketched, in square statute miles	125
Length of shore line surveyed, in statute miles	148
Area sounded, in square geographical miles	117
Number of miles (geographical) run while sounding	506
Number of sextant angles measured	3 147
Number of soundings recorded	3 736
Number of tidal stations established	4
Number of specimens of bottom preserved	7
Number of current stations occupied	1

The further results of the season's work will appear in the next annual report.

The naval officers attached to the *Patterson* during the season are as follows: Commanding officer, Lieut. Commander E. K. Moore; Lieut. A. G. Rogers, Lieut. R. F. Lopez, Lieut. Hugh Rodman, Ensign W. B. Hoggatt, Ensign H. K. Benham, P. A. Surg. R. M. Kennedy, Assistant Engineer S. E. Moses, and Draftsmen and Recorders H. L. Ford, W. G. Appleton, and Hugh Rodman.

Transportation of boundary survey parties, of chronometers between astronomical stations, and hydrographic and topographic developments.—At the beginning of the fiscal year the *Hassler*, Lieut. Giles B. Harber, U. S. N., commanding, was engaged in transporting chronometers between Pyramid Harbor and Sitka for the purpose of enabling the astronomical observers at those two points to determine their difference of longitude. In all, seven and one-half round trips were made, and during and between these trips the topography along the route traversed was sketched. At first these sketches were made from the ship, angular measurements, referring to peaks already platted on the sailing charts, being made with the sextant. This proved unsatisfactory and recourse was had to theodolite operations, but, for lack of a vertical circle, elevations were deter-

mined with the sextant. Photographs were also taken to assist the draftsman in contouring the areas involved. About 1 040 square miles of topography were sketched in this way.

Lieutenant Harber concludes his report on the season's operations with a list of corrections to the published charts and Coast Pilot.

The *Hassler* and *Patterson*, with the boundary survey parties on board, sailed from Sitka on August 20, and arrived at Port Townsend on August 30. The *Hassler* then proceeded to Tacoma, where she was laid up.

Reference to a hydrographic examination of the water front at Tacoma, in the locality of the landslide which occurred in November, will be found on a previous page.

The list of naval officers attached to Lieutenant Harber's party during the season in Alaska is as follows: Lieut. A. C. Almy, Ensign W. S. Cloke, Ensign H. K. Benham, P. A. Surg. C. H. T. Lowndes, Assistant Engineer W. C. Herbert, Draftsman C. W. Fitzgerald, Pay Yeoman P. T. Manning, and Writer T. P. Toohey.

Tidal observations at Sitka, Alaska.—The Stierle self-registering tide gauge, set up at Sitka by Assistant Fremont Morse in June, 1893, remained in operation until August 6, 1894, when the series of observations obtained being sufficient the station was discontinued. These observations have already been mentioned elsewhere in this report.

SPECIAL OPERATIONS.

Determination of geographical positions for the establishment of a speed-trial course for naval vessels in Long Island Sound.—Under date of November 3, 1894, the honorable Secretary of the Navy requested the Superintendent of the Coast and Geodetic Survey to determine trigonometrically the geographical positions of certain points along the north shore of Long Island, from the eastern end to Stratford Shoal, to facilitate the establishment in Long Island Sound of a speed-trial course for naval vessels. In compliance with this request instructions were issued to Assistant Herbert G. Ogden to proceed to the locality indicated immediately on the completion of the topographical work upon which he was then engaged in the vicinity of Quincy, Mass., and to execute the necessary supplemental triangulation. Mr. Ogden, accompanied by his recorder, left Quincy on the 22d of November and arrived at Greenport, Long Island, on the 24th. The triangulation was at once begun, and was successfully completed by December 14, Mr. Ogden reaching Washington and reporting at the Survey Office December 18. The resulting geographical positions were furnished to the Navy Department as soon as they could be computed.

The statistics of the field work are as follows:

Area covered by triangulation, in square statute miles	40
Number of signals erected	9
Number of stations occupied for horizontal measures	11
Number of geographical positions determined	18
Number of pointings made in observing	385
Number of directions determined	60

Assistant Ogden's services during the remainder of the fiscal year have already been mentioned.

Establishment of the Naval Observatory circle.—A joint resolution of Congress, approved August 1, 1894, provided for the establishment of a circle around the United States Naval Observatory, and required the United States Coast and Geodetic Survey to make the necessary surveys.

According to the provisions of the act, certain tracts of land were to be acquired by purchase, and others, already a part of the Observatory site, were to be sold in order to transform the present irregular-shaped Government property into a circle having a radius of 1 000 feet.

On September 5, Assistant E. D. Preston was directed to report to the Commissioners appointed by the Secretary of the Navy and to proceed with the work of defining the circle. This work was successfully accomplished by October 1. It was then found necessary to make a resurvey of the original plat because some of the old points could not be recovered. This resurvey was completed by October 6, and all the results, including a map, were turned over to the commissioners on October 13.

Mr. Preston was assisted in the field work by Messrs. J. B. Boutelle and C. C. Yates, and in the computations by Messrs F. D. Granger, H. F. Flynn, and R. A. Harris.

Special survey of the Fox islands, Chesapeake Bay, at the request of the Virginia State authorities.—The Fox islands lie on the eastern side of Chesapeake Bay, in Accomac County, Va., and form the dividing line between Tangier and Pocomoke sounds. The group is composed of a series of low, marshy islands of irregular shapes, separated from one another by narrow channels. The direction of the axis of the group is about north and south. About a mile to the eastward is a second series of small islets, separated by broad passages, and lying nearly in a straight line

running about north-northwest and south-southeast; these are also considered as a part of the Fox Island group. The owner of these islands being interested in oyster culture, and desiring to pursue certain investigations and experiments in developing his interests, entered into negotiations with the State authorities in order to acquire full control over a certain area of water suitable for his purpose. The result was an act of the general assembly, approved by the governor February 26, 1894, entitled "An act to define and establish by straight lines the low-water mark lines for the riparian owner of the shores of Fox Island, or Fox islands, in the county of Accomac, in the State of Virginia." In this act is a provision that the United States Coast and Geodetic Survey be requested to compute the acreage of the area between high and low water mark lines, and that their computation shall be accepted as final both by the State authorities and the riparian owner; and consequently in the spring of 1894 the parties interested made application to Superintendent Mendenhall for the necessary information. The data in the archives of the Survey being insufficient for the purpose, it was proposed on the part of the State and the riparian owner, and agreed to on the part of the Superintendent, that a new and special survey be made, the expenses of the same to be borne by the parties interested. No action could be taken however at that time, as the assistants of the Survey were otherwise employed, and the matter was necessarily deferred until the spring of 1895, when the present Superintendent of the Coast and Geodetic Survey, with the approval of the honorable Secretary of the Treasury, directed Assistant W. C. Hodgkins to proceed with the work.

Tidal observations for the determination of the plane of mean low water were begun March 27, and the topographic and hydrographic survey early in May. Some triangulation was necessary, as the old points of the former survey had mostly disappeared, and a base line, 1 319 metres in length, was measured by means of a steel tape on Great Fox Island. The topography and hydrography followed in order, and were completed by May 28. The tide gauge was kept running, under the charge of Mr. R. W. Maupin, until the close of the work, so that with the exception of a few tides, lost through accidental causes, we have a three months' continuous series of observations.

The only specially notable feature developed in this survey is the great amount of erosion that has taken place along all parts of the shores of these islands since the former survey was made. The total loss since 1851 is estimated by Assistant Hodgkins as 36 per cent of the existing area, a ratio of wear that seems to indicate that the Fox islands will, before many years, disappear entirely. The wear is most marked, of course, on the western or Tangier side, the extensive shoals on the Pocomoke side materially reducing the effect of storm waves.

On the completion of the survey, Assistant Hodgkins returned to Washington, and was engaged on his office work until assigned to duty on the Hudson River Survey, as already mentioned on a previous page.

The statistics of the Fox islands work are as follows:

Number of base lines measured	1
Area of triangulation, in square statute miles	10
Number of signals erected	21
Number of stations occupied for horizontal angles	11
Number of miles of leveling	8
Number of azimuth stations occupied	1
Area of topography, in square statute miles	1
Length of coast line surveyed, in statute miles	16
Number of topographical sheets	1
Area sounded, in square geographical miles	10
Number of miles of sounding lines run	103
Number of angles measured	1 936
Number of soundings taken	11 363
Number of tidal stations occupied	1
Number of hydrographic sheets	1

Physical hydrography.—Continuation of the surveys of the location and mapping of the natural oyster beds in the waters of the State of Virginia.—This important work, commenced in 1892 at the request of the governor and legislature of the State of Virginia, and which has been continuously under the charge of Assistant J. B. Baylor, has now been completed. Field and office work pertaining to this survey occupied Mr. Baylor during the present fiscal year from July 1, 1894, to May

20, 1895, and during that time seven elaborate oyster charts have been prepared and printed in colors, and two reports containing 106 pages of printed matter, giving angles, distances, etc., as determined trigonometrically from marked shore stations, have been published.

The statistics as given by Assistant Baylor are as follows:

In Accomac County (ocean side) 69 natural oyster rocks were surveyed, embracing an area of 14 242·2 acres.

In Northampton County (ocean side) 49 natural oyster rocks, embracing an area of 30 349·3 acres, were surveyed.

Six hundred and eighty-five corners of natural oyster rocks were determined by angular measures from shore stations.

The printed reports referred to contain, in addition to the distances and bearings of the corners from the shore stations, the depths of water, tidal information, descriptions of stations, and full directions to the civil engineer and others for finding any desired corner. The method of conducting the work and making the determinations is also described.

All expenses of this work throughout its continuance, excepting the salary of the chief of party, have been paid by the State of Virginia, but during the last season the United States Commissioner of Fish and Fisheries placed the steam launch *Petrel* and her crew at Mr. Baylor's disposal while engaged on the field work. On the completion of the survey Mr. Baylor was directed to make magnetic observations at various points along the Atlantic coast. This work will be noticed in another part of this report.

Mobile Bay and vicinity; survey of oyster grounds for the United States Commissioner of Fish and Fisheries.—As mentioned in the report for 1894, Mr. Homer P. Ritter, at the request of the United States Commissioner of Fish and Fisheries, and by direction of the Superintendent of the United States Coast and Geodetic Survey, made a survey of the oyster beds of Mobile Bay and vicinity during the months of February and March of that year. The observed water densities, however, proved unsatisfactory, owing to the fact that during the whole time the survey was in progress extensive freshets prevailed in the streams tributary to Mobile Bay, and the waters of Mobile Bay and Mississippi Sound were consequently much less saline than under normal conditions. The Commissioner of Fish and Fisheries therefore requested that Mr. Ritter, on his return from Alaska, where he had meanwhile been assigned to duty in connection with the International Boundary Survey, be again detailed to supplement the first survey and to redetermine the water densities. Mr. Ritter accordingly proceeded to Mobile Bay in the latter part of November, 1894, chartered a small oyster schooner, and began work December 1. Temperature and density observations were repeated throughout the oyster area, and additional angles and soundings were measured, and some additional specimens were collected. The work was completed by December 8, and Mr. Ritter then returned to Washington. He has submitted a full report on the surveys, and a map embodying their results, copies of which have been furnished to the Commissioner of Fish and Fisheries.

Resurvey of the international boundary line between the United States and Mexico.—From July 1, 1894, to January 5, 1895, Assistant A. T. Mosman continued on duty as member of the International Boundary Commission, with headquarters at San Diego, Cal., the time until October 11 being occupied in completing the field maps of the northern side of the boundary.

On October 11 the Joint Commission adjourned to meet in Washington, D. C., one year from that date, and all records and maps pertaining to the United States section were sent to the State Department early in November.

Mr. Mosman was instructed by the honorable Secretary of State to report to the Superintendent of the United States Coast and Geodetic Survey on January 5, 1895, for duty under his direction until October 1, when his services will again be required on the Boundary Commission. Mr. Mosman was assigned by the Superintendent to duty in the computing division, and served until June 4, when he was directed to assume temporary charge of the drawing division. On June 30 he proceeded to New Orleans, La., to assume charge of the telegraphic longitude party operating in that section of the country.

Continuation of the resurvey of that part of the boundary line between the States of California and Nevada which extends from a point in Lake Tahoe to the Colorado River.—On the completion

of the longitude work at Seattle and Tacoma, Wash., near the close of the previous fiscal year, Assistant C. H. Sinclair proceeded to San Francisco and made preparations for the resumption of work on the California and Nevada boundary line, intending to take the field on the 1st of July, and meanwhile Assistant Walter B. Fairfield was engaged in selecting and purchasing the necessary live stock and outfit and transporting them to Carson City, Nev. Owing to the great railway strike inaugurated June 28, Mr. Sinclair was unable to leave San Francisco until July 27, causing a vexatious delay and a loss of nearly a month of the most favorable time for field work. The instruments sent from Washington for the use of the party were delayed for the same reason and did not arrive at Carson City until the latter part of July.

The party was organized at Carson City, and on July 29 reached the southeast end of Lake Tahoe, where an azimuth was determined in order to begin the ranging out of the oblique boundary. Mr. Sinclair took personal charge of the ranging out of the line, and detailed Assistant W. B. Fairfield to take charge of the triangulation, topographical sketching, and magnetic observations. The point selected for the azimuth was 805·15 metres due north of the longitude pier of 1893, being the computed position of the intersection of the meridian of that station with the oblique boundary near its northeast end. From the azimuth station a point was fixed 460·5 metres northwest, near the shore of Lake Tahoe, and called "Initial, 1894." The azimuth station itself is designated as "T_1," and successive points along the line as "T_2," "T_3," "T_4," etc. For the first part of the line the sights were short, "T_1" being only 4 miles distant from "Initial," but from "T_7" a number of points in the Carson Valley were located, the farthest one being "T_{22}," on the summit of the Antelope Range, a distance of 16·4 miles. Then the theodolite was taken back to "T_6," as that point had greater elevation, and points located to "T_{32}," on the east slope of the "Middle Sister," in the Sweetwater Mountains. To this point was a clear sight of 43·8 miles, the longest sight in ranging out a boundary line of which we have any record, but it was greatly exceeded by the following one from "T_{32}" to the White Mountains, a distance of 68·8 miles. This great sight was made with the aid of a small pocket Steinheil heliotrope with a mirror only 1 by 1¼ inches, and the signals were clearly interpreted at that distance. This point is "T_{60}," and is the southeast limit of the ranging-out work of the season, a total distance of 116·2 miles from "Initial." Points were located on the summit of all important ridges on the line and at the crossing of the Carson and Colorado Narrow Gauge Railroad, and, as will be seen from the number of points established in the given distance, the average distance apart of the points to be permanently marked is less than 2 miles. The points were temporarily marked by a drill hole in the rock, in which were set poles surrounded by piles of stones.

As the ranging-out work progressed more rapidly than the triangulation, and as it was desirable to keep the two classes of work together, Assistant Sinclair from time to time suspended the ranging-out operations and assisted the other branch of the party. The triangulation was carried along over the high mountains just south of Lake Tahoe, thence across the Carson Valley and over the Antelope Range, thence across the Antelope Valley and over the Sweetwater Mountains, and finally to the summit of the White Mountains, a total distance of 116 miles, and hence bringing the triangulation to the limit reached by the ranging-out party. The base for this triangulation was derived from the primary triangulation of the Coast and Geodetic Survey, which in crossing the continent passes near Lake Tahoe. The sides of the triangles are from 2 to 5 miles in length, and the angles were measured for the most part with a 6-inch repeating theodolite. For some angles, however, a 10-inch instrument was used. In the course of the work a number of the old boundary posts, located by Von Schmidt in 1873, were found, and in all cases these were carefully determined by the triangulation party. During the progress of the work the magnetic declination was determined at all points on the line, and observations for height were made at all line points and at most of the trigonometrical points. The topography was also sketched throughout the line for a distance of half a mile on each side.

Both sections of the party were able to subsist on the country at the various ranches and small hotels, and hay and grain for the animals could generally be procured in the immediate neighborhood of the work; but over one section of the line a desert 30 miles in extent had to be traversed, and here some difficulty was encountered on account of the total absence of water. The teams of the party had, therefore, to be employed a part of the time in carrying water from a

distance for the use of the men and animals. The whole party consisted of eleven men and the two officers named, with two four-mule teams, one thorough-brace wagon drawn by a pair of mules, and thirteen saddle and pack animals.

On the completion of the triangulation, November 10, the whole party returned to Carson City, reaching that point November 16, where the instruments, wagon, and outfit were stored, and the animals quartered for the winter. While this was being done, magnetic observations were made at Carson City and at Lake Tahoe. The magnetic station at Carson City was located in the grounds of the Pardion and in the meridian of the transit of Mr. C. W. Friend's observatory (one square south of it). The station was marked so that it can be recovered when necessary in the future. The station at Lake Tahoe was located 25 metres due south of the longitude pier of 1893, near the Lakeside Tavern, at the southeast end of the lake. Magnetic bearings of the lines of the triangulation were also observed during the progress of the work with a compass declinometer.

On the completion of the magnetic observations, and the storing of the property, Messrs. Sinclair and Fairfield, in accordance with instructions, returned to San Francisco, and after conference with Assistant George Davidson, who was charged with a general supervision of matters connected with the boundary survey, and settling up of party accounts, proceeded to Washington. The office work and computations pertaining to the field work were then taken up and continued until interrupted by the assignment of Messrs. Sinclair and Fairfield to other field duty; the former, on February 1, 1895, to telegraphic longitude work in the Southwest, and the latter, on May 16, to the California and Nevada boundary work.

The statistics, on account of the noncompletion of the office work, are incomplete, but may be given in part as follows:

Number of miles of line ranged out	116·2
Number of line points located	60
Number of ranging-out stations occupied	16
Number of azimuths observed	1
Number of signals erected for triangulation	37
Number of stations occupied in the triangulation	65
Number of points trigonometrically determined	106
Number of horizontal angular measurements	13 542
Number of magnetic declinations determined with compass declinometer	60
Number of magnetic stations occupied with magnetometer and dip circle	2

An account of Assistant Sinclair's longitude work in California, New Mexico, and Texas, and also of his and Assistant Fairfield's subsequent work on the California and Nevada boundary line, will appear under the appropriate headings elsewhere in this report.

Resumption of the resurvey of the oblique boundary line between the States of California and Nevada in the spring of 1895.—On May 15, 1895, Assistant C. H. Sinclair was directed to make preparations for the resumption of the resurvey of the oblique boundary line between the States of California and Nevada, from the point reached in the previous season, and Assistant W. B. Fairfield was again assigned to his party. Assistant A. L. Baldwin was also assigned to the party. Messrs. Sinclair, Fairfield, and Baldwin left Washington on May 22 for San Francisco, where the final preparations were completed by June 3. The party then proceeded to Carson City, Nev., and from this point to the field of operations, a distance of over 150 miles, it was necessary to drive, there being no railway transportation. This drive was accomplished in five days, and work was commenced on the 14th of June at line station "T_{59}," where the Carson and Colorado Railroad crosses the boundary line. Here an azimuth was observed and a check base 1 080 metres in length was laid out and twice measured with a steel tape. The base was measured along the rails of the railroad, and was subsequently connected with the triangulation in the usual manner. Mr. Sinclair again took charge of the ranging out of the line, and Mr. Fairfield of the triangulation, topographic sketching, and magnetic observations. To Mr. Baldwin was assigned the charge of the forward subdivision of the ranging party. The ranging out began at "T_{60}," the southernmost point reached during the former season, on the summit of the White Mountains, and at an elevation of nearly 14 000 feet above sea level. This station is very difficult of access, and

the climbing arduous and in places dangerous. A start was made for the summit on June 17, and Mr. Sinclair's section of the party camped for the night at the highest point where water is to be found. The ascent was continued the next morning, but it was soon necessary to leave the animals and continue without them, and after five hours of severe exertion the summit was reached. It was then necessary to shovel away the snow in order to see forward to the next station, 12 miles to the southeast. This latter point, which overlooks the Fish Lake Valley and commands the country for 30 or 40 miles, was next occupied. Line points are being located every few miles across this valley, and on all the conspicuous ridges, as far as the topography of the country will permit.

Assistant Fairfield has connected the base line above referred to with the triangulation, and is now carrying the latter across the southeast slopes of the White Mountains, a very difficult and troublesome region to traverse with a small scheme of triangulation. The work will probably proceed this season with greater rapidity than last, as the employment of two additional men will much facilitate the execution of the reconnaissance and the erection of signals.

Mr. Sinclair, in his report, acknowledges in complimentary terms the hearty cooperation of Assistants Fairfield and Baldwin in every phase of the work, and the commendable zeal displayed by every member of the party.

At the close of the fiscal year the party was still in the field, and the statistics of the work will therefore appear in the next annual report.

Special topographic and hydrographic survey of the vicinity of the Port Orchard dry dock, Washington, for the use of the Navy Department.—The honorable Secretary of the Navy having made requisition on the Coast and Geodetic Survey for a large scale detailed topographic and hydrographic survey of the vicinity of the Port Orchard dry dock, Puget Sound, Washington, Assistant J. J. Gilbert was at once detailed to execute the work.

Mr. Gilbert left Olympia on the 23d of April, arriving at Port Orchard on the following day, and immediately began operations. Hands for his party were at first supplied by the naval officer in charge of the dry dock, but subsequently a crew was detailed from the steamer *Hassler*. The shore line was traced and the topographic details delineated by means of the plane table, on a scale of 1-1 000, and the elevation contours for successive intervals of 3 feet were accurately located by actual spirit leveling. The hydrography was closely surveyed to a depth of 6 fathoms, the sounding lines being run at intervals never exceeding 50 feet. The survey was completed by May 20, and the finished sheet was a few days later forwarded to the Coast and Geodetic Survey Office, where a certified copy was made for the use of the Navy Department.

Assistant Gilbert, on the completion of the work, returned to Olympia and resumed the computation of his triangulation of 1894. At the close of the fiscal year he was engaged in making preparations for the resumption of field work in Washington Sound.

Alaska boundary work.—Chronometric exchanges of time comparisons between Sitka Observatory and Pyramid Harbor Station, for the determination of the longitude of the latter.—At the beginning of the fiscal year Assistant Fremont Morse was engaged in making time observations at Sitka in connection with chronometric longitude determinations for the Alaska Boundary Survey. Chronometers were carried in the usual manner by the steamer *Hassler* between Sitka and the astronomical station at Pyramid Harbor near the head of Lynn Canal. The chronometers were in charge of Mr. James Page, a member of Mr. Morse's party, and were intercompared daily, and on the arrival of the steamer at either station they were compared by two observers with the station chronometers. Time observations were made on every clear night in order to determine accurately the chronometer rates. Longitudes were also determined in the same manner at two of the steamer *Patterson's* stations, viz, at Freshwater Bay and Killisnoo.

During the season the tidal observations at Sitka were also continued until August 6, at which date the series begun June 27, 1893, were considered complete. Magnetic observations were also made at the Sitka magnetic station.

The longitude work was finished by August 19, and Assistant Morse then returned to San Francisco where he completed the records and computations pertaining to his field work. He was then engaged with Assistant Davidson in latitude computations and miscellaneous office work until the following spring, when he was reassigned to the determination of Alaskan longitudes, as already mentioned in another part of this report.

The principal statistics of the season's work are as follows:

Number of azimuths observed	1
Number of nights on which time observations were made	34
Number of magnetic stations occupied	1

Survey from the south end of Malaspina Base to the Yahtse River, and determination of points near Lituya Bay.—The completion of the survey of this stretch of coast was described in the annual report for 1894.

Assistant McGrath, in his report dated January 10, 1895, furnished a more detailed description of the progress and results of this survey. His topographic map covers the coast from the Osar River to Icy Cape in front of the Malaspina Glacier. A large forest fills the area that is bounded by the Osar River on the east and the Manby on the west. The dense growth of spruce extends up to the very foot of the moraine that marks the glacier, and on its inner edge the occasional spasmodic advances of the glacier have recorded themselves in the destruction caused in the forest by such invasions.

The Manby River flows through a wide plain which is thickly overgrown in the summer with wild rye and peas. Bordering the drainage basin of the Manby in the east is found a section which is dotted with thrifty patches of woods. At a distance of about 16 kilometres from Point Manby the great glacier advances to the very edge of the sea, and for 13 kilometres a most painful and difficult course must be pursued to reach the west end of the icy Sitkagi Bluffs. Receding again from the shore line, the face of the glacier sweeps inland to a distance of 7 kilometres from the shore at the center of the Yahtse Delta, and then it curves seaward to Icy Cape, where the ice begins to discharge again into the ocean.

The distance from the west end of the Sitkagi Bluffs to Icy Cape is about 42 kilometres. This section is traversed by many arms of the Fountain, Yahna, and Yahtse rivers. In this stretch are several lakes and patches of forest. The seacoast border of the delta of the Yahtse was a great expanse of glacial mud at the time of Mr. McGrath's visit. In ordinary seasons the shore of this region assumes a very friendly aspect. Dense grass springs up everywhere, and the bright green of this vegetation is variegated and beautified by the gay colors of countless wild flowers. Strawberries grow in great abundance, but had not ripened at the time of his departure, while in 1892 many were gathered as early as July 4.

The absence of gold-bearing sand was noted. The men of the party tried it in various places without getting any pay prospect; though in one spot, near East Yahtse Base, several patches of ruby sand were found, there was not enough of this material to warrant anyone in taking up a claim and working it.

Just to the eastward of where the glacier enters the sea a small, sandy islet was discovered. This makes a fine lee during the prevalence of easterly winds (the prevailing summer wind), and affords the best landing place between the Osar River and Yakategi. The dangers incident to landing along this beach were sadly exemplified in the loss of six men by drowning when Professor Russell's party disembarked near the mouth of the Yahtse River. Only a few miles west of the scene of this tragedy was the little harbor above referred to. The depth of water in it makes the place useless as an anchorage for anything larger than the small sloops used by seal and otter hunters and minor traders who go up and down this coast, but as it is almost at the nearest point of the coast to Mount St. Elias a knowledge of it may prove of some value to future expeditions which may be planned to attempt the ascent of the mountain from the side that Professor Russell essayed in his first trial.

While awaiting the coming of the *Patterson* at his camp on the Osar, Assistant McGrath made observations to check the distances and elevations of Mount St. Elias and Mount Logan, which had been determined from the Malaspina Base in 1892.

The *Patterson* arrived on August 2, and transferred Assistant McGrath's party to Lituya Bay, off which she arrived on August 4.

Since the loss of 21 officers and men of La Perouse's expedition at the entrance of Lituya Bay, this latter has borne the reputation of being very dangerous. La Perouse, however, entered it with his two vessels in 1786, and Captain Hereendeen, who piloted the Coast Survey schooner *Yukon* into it in 1874, has visited the bay in a whaleship. The strength of the tidal current

pouring in and out of the bay was shown by the foaming white waters of the ebb tide, which could be noted by the *Patterson* nearly a mile outside the rocks which marked the channel way.

Awaiting the slack of the tide, Mr. McGrath's party was landed by the small boats of the *Patterson*, which returned to Yakutat Bay to await the completion of the work assigned to Mr. McGrath. While in the bay it was learned that miners, with only the most elementary knowledge of handling sailing vessels, frequently pass in and out of the bay without accident, and Mr. McGrath concludes that the entrance to the bay is undeserving the terrible reputation it has. Vessels may often have to lie off the mouth of the bay to await a proper stage of the tide, and that this can be conveniently done, if the wind is favorable, was shown by the fact that the *Patterson* found a good anchorage fully a mile out from the shore. Lituya Bay may become important if the mining industry in the Fairweather region continues to increase. In that case it must become the principal depot of supplies, as no other harbor can be depended upon between Cross Sound and Yakutat Bay.

There is at present no permanent Indian settlement on the bay, though, according to legend, a flourishing village existed on its eastern shore before the advent of the whites in the country, but a great wave swept in one day and drowned all the inhabitants except two, and since then only hunting cabins have been established. There were, however, about twenty white men living on the bay engaged in working the "ruby" sand between the bay and Cape Fairweather, for the beaches in the vicinity produce considerable gold.

On the outside of the beach just west of the bay Mr. McGrath found a stretch suitable for measuring a base about 1·6 kilometres in length, which he expanded to a length of about 5·4 kilometres, and from this base horizontal and vertical angles were obtained on all the prominent peaks within sight. A solar azimuth was measured also, and at one station the magnetic declination was obtained with the aid of a compass declinometer. There was no difficulty in determining the positions and elevations of Mount Fairweather, Mount Lituya, Mount La Perouse, and Mount D'Azelet, but if the published value of the elevation of Mount Crillon is correct, then the peak is hidden from the beach about Lituya by a high mountain which is in line and between it and the shore.

The field work was completed August 12, and the *Patterson* arrived on the next day. Throughout the season Mr. McGrath was efficiently assisted by Dr. H. W. Edmonds, whose loyalty, energy, and ability he highly commends.

On the 14th the party reembarked and was ready to start southward again. Port Townsend was reached on August 30, where some of the men were discharged. Others continued on the *Patterson* to San Francisco, where they arrived on September 7. Having discharged the men, completed his inventories, and stored the equipage, Mr. McGrath returned to Washington.

The principal statistics for the season are given as follows:

Base lines, secondary, length of, in metres	7 625
Beach measurement in statute miles	38
Area of triangulation, square statute miles	396
Geographical positions determined, number of	15
Elevations determined trigonometrically	15
Azimuth stations, number of	2
Number of day azimuth observations	2
Number of stars observed for azimuth	2
Magnetic declinations determined	2
Topography:	
Area surveyed, in square statute miles	105
Length of coast line, in statute miles	66
Length of shore line of rivers, in statute miles	43
Length of shore line of creeks, in statute miles	34
Topographic sheets finished, scale 1-80 000	2

Triangulation and topographic reconnaissance of Chilkat and Taiya inlets.—The party under the direction of Assistant J. F. Pratt continued the survey of the Chilkat and Taiya inlets, a brief account of which was given in the last annual report, until August 16 of the present year. The Chilkat Inlet and River were completed by July 14, and the triangulation and topographic reconnaissance of the Taiya Inlet and River were at once begun and carried as rapidly as weather

conditions would permit to a point a little beyond the "ten marine league" limit. The wind blows strongly and continuously in these inlets at this season of the year, and as the shores are steep and rocky, the landing with canoes and small boats was more or less hazardous. The Taiya is a glacial stream, navigable for small boats for about 6 miles above the mouth, but the navigation is difficult and dangerous on account of the rapid and swirling current and the strong winds already mentioned. The party had considerable wading to do at places, and in water but 2 or 3 degrees above freezing point. The valley of the Taiya is rather narrow, its bottom composed of gravel beds dividing the stream irregularly and forming numerous islands, most of which are covered with a dense and tolerably large growth of cottonwood trees. This rendered triangulation difficult and expensive, and, therefore, for a considerable part of the distance, direct measurement with steel tapes was resorted to. Long azimuth lines were observed to control the directions, and two bases were measured to control the distances in the triangulation between the mouth of the Katsehin River and the head of Taiya Inlet.

The topographic reconnaissance was also satisfactorily accomplished to a junction with the work of Messrs. J. A. Flemer and H. P. Ritter, and the magnetic declination was observed at one station on the Taiya River. On August 9 the party moved to Anchorage Point and made a trigonometric connection across the peninsula between the Chilkat and Chilkoot inlets. Work was completed by August 16, and the party, with its camp and outfit, was taken on board the steamer *Hassler* and the schooner *Earnest* and conveyed to Puget Sound via Sitka.

Subassistant F. A. Young, Aids J. F. Hayford and A. L. Baldwin, and Recorder T. C. Taylor were attached to the party during the season and rendered acceptable service.

On the arrival of the *Hassler* at Seattle, on August 30, the instruments and outfit were stored, and the party disbanded. Mr. Pratt then took up the office work, and Messrs. Young, Hayford, and Baldwin proceeded to Washington, D. C., and were assigned to duty in the office.

Subsequently Assistant Pratt was ordered to Washington for the purpose of taking charge of the instrument division of the Office. He left Seattle on the 28th of December, 1894, reached Washington January 7, 1895, and entered on his new duties as chief of the instrument division January 18.

The statistics of the season's work in Alaska are given as follows:

Area of triangulation, in square statute miles	90
Number of points selected	211
Number of secondary bases measured	7
Number of signal poles erected	190
Number of stations occupied for horizontal measures	177
Number of stations occupied for vertical measures	19
Number of geographical positions determined	211
Number of elevations determined trigonometrically	21
Number of astronomical stations occupied	1
Number of magnetic stations occupied	4
Area of topographic reconnaissance, in square statute miles	135
Length of river and creek shore line mapped, in statute miles	43
Number of topographical sheets completed	1

Topographic reconnoissance to the northward and eastward of Taiya Inlet and River, Alaska.— Assistant Flemer's report of the results of his topographic reconnaissance, begun during the last fiscal year, around Chilkoot and Taiya inlets, is dated January 19, 1895. The shore line and adjacent topography were platted and sketched, using a small mountain plane table of Coast Survey pattern, while the topographic features of the interior country were secured by photographic panorama views, taken from prominent mountain peaks, as well as from lower camera stations. On the plane table he used for the greater part of the work a xylonite sheet, which gave very satisfactory results in the humid atmosphere of the coast, under circumstances which would have made the use of paper an impossibility. He states that he would consider xylonite an ideal substance for plane table sheets in wet weather if he had not found that on his return it showed a decided contraction under the influence of the drying atmosphere of Washington.

His report dwells largely on the methods best adapted to secure satisfactory photographs for topographic purposes. The use which he made of the camera largely extended the area covered by his reconnaissance.

He reports the mountains between the Chilkat, Chilkoot, Taiya Sahnka, and Taiya inlets as forming either groups by themselves or spurs emanating from the range forming the divide between the feeders of these waters and the head waters of the Yukon. These mountains are so cut up by glacial abrasion, and by erosion, that they often appear divided into separate distinct groups rather than to be outrunners and spurs of the interior range, yet the highest peaks increase in elevation when going inland toward the dividing range, which is crossed by the Chilkat, Chilkoot, Perrier, and White passes, which at present offer the only means of reaching the head waters of the Yukon and Dease waters from the south and west. At present the principal road of ingress is through the Taiya Valley over Perrier Pass, which is about 1 190 metres (3 900 feet) high. It is about 20 miles from the mouth of the Taiya River (Wilson's store) to the summit of this pass, and 13 miles from there to Lake Lindeman on the other side.

Skaguay River Valley was explored by Mr. Poudre in 1891, and by others, in the hope of finding a shorter road to the interior, but it was found to be unsuitable for a trail across the mountains.

Mr. Poudre gives the following distances:

	Miles.
Mouth of Skaguay to first fork	12
Mouth of Skaguay to above timber line	13
Mouth of Skaguay to summit (White Pass)	18

The principal statistics of the season's work are given as follows:

Topography—plane table reconnaissance:	
Area, in square statute miles	165
Total area, including photography, square statute miles	300
Length of general coast line, statute miles	67
Length of shore line of rivers and creeks, statute miles	30
Topographic sheets, scale 1-80 000	4

The season's work closed August 14, and Mr. Flemer returned by the steamer *Hassler* to Port Townsend, and after disbanding party, proceeded to Washington, where he was occupied for some time in reducing and platting the results of his photographic work. His subsequent services in the eastern section are noticed elsewhere in this report.

Topographic reconnaissance to the northward and westward of Chilkat Inlet and River.—The topographical party under the charge of Mr. Homer P. Ritter began work at Pyramid Harbor on the 15th of May, 1894, and its progress to the close of that fiscal year was noted in the last annual report.

Work was continued during the early part of the present fiscal year, and a considerable area of difficult country was mapped, principally by means of the mountain plane table. The triangulation of 1890 was utilized for this work, and additional points were furnished from time to time by the party of Assistant J. F. Pratt, operating in the same region. The topography was developed on both sides of the inlet to the mouth of the Chilkat River, and the camp was moved to the mouth of the Takhin. From this point a large area was obtained, and numerous excursions were made up the valley of the Takhin as far as Bertha Glacier, and also to the head of the Chalzekahin River. The moving of camp through this country was a work of great difficulty, the boats having to be dragged over innumerable quicksand bars, and progress on land was much impeded by the dense and tangled growth of underbrush, through which it was necessary to cut trails. From the last camp occupied by the party the topography of the valley and adjacent mountains was developed as far as Klukwan and the northern end of Chilkat Lake.

On the 14th of August the work of the season closed, and Mr. Ritter proceeded to Pyramid Harbor, where the steamer *Hassler* was waiting to convey the various parties to Puget Sound. She sailed on the 16th, and arrived at Seattle August 31. Here the party was disbanded, and Mr. Ritter, in accordance with instructions, returned to Washington.

The results of the reconnaissance are shown on a topographical map which has been completed and turned into the archives of the Survey. The area surveyed during the season was 315 square statute miles.

Mr. Ritter's subsequent services in Mobile Bay, Alabama, have already been mentioned on a previous page of this report.

Topographic reconnaissance on Chilkat and Chilkoot inlets.—It was stated in last year's report that Assistant E. F. Dickins, after having completed the reconnaissance survey of the Unuk River, transferred his party to Chilkat Inlet. On June 18 he began the topographic reconnaissance of the inlet, connecting with Mr. Ritter's work near the Guanegastaki Village, and having finished this work on July 18 he transferred his party to the Chilkoot, filling in the topography of the lower part of the inlet and connecting with Assistant Flemer's work. This task was completed on August 12, and three days later he sailed for Sitka on the *Hassler*, from which ship he transferred his party to the *Patterson*, reaching Port Townsend on her on August 30.

At this point Mr. S. B. Tinsley, by direction of the Superintendent, was relieved from duty on the party and proceeded to Washington, D. C. Mr. Dickins proceeded by rail to San Francisco, and on the arrival there of the *Patterson*, September 8, landed and stored his outfit and instruments and disbanded his party. He then occupied himself at the suboffice in the completion of his records and computations.

Assistant Dickins commends the services of Mr. S. B. Tinsley, temporary aid, for his willingness to do all in his power to advance the work.

The principal statistics of his work are given as follows:

Area of topography covered, square statute miles	118
Miles of shore line surveyed	65
Elevations determined trigonometrically	74
Miles of rivers surveyed	5
Number of signals erected	38

Alaska boundary work.—Triangulation, topography, astronomical determinations of latitude and azimuth, and chronometric determinations of differences of longitude.—The initial points of the boundary line between British Columbia and southeast Alaska depend at present on the rather crude triangulation executed in past years by the naval hydrographic parties. This triangulation, while sufficiently good for mere charting purposes, for which it was only intended, does not possess the accuracy necessary for such important work as the location of a boundary line, its bases having been measured by rough and only approximate methods, and its angular measurements and astronomical determinations having in many cases been made by inexperienced observers. The discrepancies that have developed in the attempt to fit together and adjust the different sections of this work prove conclusively that a better triangulation and additional astronomical observations are necessary to afford a reliable basis for the boundary survey. It was therefore determined to fit out a strong party of civilian assistants to measure a base, determine astronomical positions, and execute a new triangulation from Port Simpson to Marys Island, and to the head of Portland Canal. The general programme of the work outlined was as follows: The steamer *Patterson*, while en route to her own field of work in Chatham and Peril straits, to transport the parties, with their outfits, stores, etc., from San Francisco and Seattle and land them at their respective stations; the astronomical and chronometric longitude work to be first undertaken, astronomical stations being established at Port Simpson, Marys Island, and the head of Portland Canal, and the astronomical station at Seattle to be used as the base station for longitudes; Assistant Fremont Morse to occupy the Seattle observatory, while the astronomical stations at Port Simpson, Marys Island, and head of Portland Canal were simultaneously occupied by the parties of Aid O. B. French and Assistants E. F. Dickins and P. A. Welker, respectively; nine chronometers, in charge of Assistant F. A. Young, to be carried on four successive trips of the steamer *City of Topeka*, between Seattle and the stations at Port Simpson and Marys Island, while the steamer *Fuca*, with five chronometers, similarly plied between Port Simpson and the head of Portland Canal; base lines to be measured at or near Port Simpson and the head of Portland Canal, and such triangulation, topography, magnetics, and other necessary work as could be accomplished without interfering with the longitude determinations to be also carried on; on the successful completion of the astronomical work, Assistant Morse to return to San Francisco, and all the Alaskan parties to be consolidated under the direction of Assistant E. F. Dickins, for the execution of the main triangulation.

Assistants E. F. Dickins and Fremont Morse, with two men and the outfit and stores for four parties, joined the steamer *Patterson* at San Francisco on April 11, and the latter was landed at

Seattle on the 17th. Assistant P. A. Welker, Aids O. B. French and C. C. Yates, and Extra Observers H. A. Grady and R. L. Livingston, with eight men and the remaining party equipments, joined the steamer at Seattle on April 22. Mr. French was landed at Port Simpson April 29; Messrs. Welker, Yates, Grady, and five men, and the steam launch *Fuca* and crew of three men, at Lion Point near the head of Portland Canal on May 2; and Messrs. Dickins and Livingston and two men at Marys Island on May 4. Sites for astronomical stations were at once selected and the building of piers and observatories begun. Owing to rainy weather time observations were not obtained at either station until May 14, but after that date, and to the close of the fiscal year, when the astronomical work was practically finished, no serious interference from that cause occurred, except at the Mary Island station.

Mr. O. B. French reports that by the end of June the astronomical work at Port Simpson station, including time, latitude, and azimuth, was entirely completed, and the station connected by a small triangulation with previous stations.

Assistant E. F. Dickins reports the successful completion of the time observations for the longitude determination at the Mary Island Station, but some additional latitude observations are still necessary, as clouds and fogs considerably delayed this work.

Assistant Welker reports the successful completion of all the astronomical observations at the Point Lion Station, near the head of Portland Canal, and also that Aid C. C. Yates, under his direction, had measured a base 1 297 metres in length at the mouth of Salmon River, carried the triangulation from it to the mouth of Bear River, and run a traverse from the latter point to the fifty-sixth parallel of north latitude. The valley of the Bear River has an average width of 1 mile, but is so covered with a dense growth of brush and large cottonwood trees that a triangulation up the river was considered impracticable on account of the labor and expense involved, and it was decided by Mr. Welker to substitute the traverse line, in which the distances were accurately measured with a steel tape. This also was a work of some difficulty owing to the numerous crossings of swift mountain streams, but the result obtained was satisfactory, and probably better than could be expected from a small scheme of triangulation. The length of the traverse line is 8 472·8 metres, corrected for temperature, inclination, and catenary. The azimuth observed at the astronomical station was carried to Bear River in one sight, and to the fifty-sixth parallel in four additional sights. Six points of the old hydrographic triangulation were also determined, and a topographic survey made from the vicinity of the astronomical station to the boundary line.

Mr. Welker furnished the following tabulation of the results accomplished by his party to the close of the fiscal year:

Number of time determinations	20
Number of exchanges of time for longitude determinations	11
Number of latitude observations	93
Number of observations for micrometer value	5
Number of determinations of azimuth	13
Number of observations for horizontal angles	15
Number of signals erected	17
Number of base line measurements	3
Number of traverse line measurements	2
Number of determinations of magnetic elements	3
Area of topography surveyed, in square statute miles	20
Number of photographic negatives made for topographic use	63

Assistant F. A. Young, with nine chronometers, made four round trips on the steamer *City of Topeka*, attended to the winding of the instruments and their daily intercomparison on each arrival at an astronomical station, and carefully compared them with those of the station. These comparisons were also repeated by the astronomer of the station.

The steamer *Fuca*, carrying five chronometers, during the same time made seven and a half round trips between Port Simpson and the station at the head of Portland Canal. The data thus obtained will furnish 72 determinations of the longitude of the Port Simpson and Mary Island stations, and 65 for that at the head of Portland Canal.

Assistant Fremont Morse, at the Seattle base station, observed for time on thirty-five nights during the season, and on each arrival of the *City of Topeka* compared his chronometer with those

carried by Assistant Young. By the close of the fiscal year three and a half round trips had been completed, and the fourth was finished a few days later, viz, July 7. Mr. Morse then dismounted and packed his instruments and returned to San Francisco, in accordance with his instructions, arriving there on the 20th of July.

Occupation of the Seattle astronomical station in connection with chronometric longitude determinations in Alaska.—The Seattle astronomical station, in the grounds of the Washington State University, was used as the base station for the determination of chronometric longitudes in Alaska, and was occupied for this purpose by Assistant Fremont Morse. Mr. Morse was landed by the steamer *Patterson* on April 17, 1895, and immediately began the preparation of the station, and mounted a meridian instrument for time observations. His standard chronometer was rated by means of time observations on every clear night, and the other two were daily compared with it at the time of winding. Special precautions were taken to protect the chronometers from sudden or extreme changes of temperature, so that the daily range to which they were exposed did not exceed 2° C. The first time observations were obtained on April 23, and 35 complete series were obtained during the season. A set of nine chronometers, also carefully protected and intercompared daily, was carried by Assistant F. A. Young on the steamer *City of Topeka* on four consecutive round trips between Seattle and the Alaska stations at Port Simpson and Mary Island, and carefully compared with the station chronometers at the beginning and end of each trip, and by both observers.

The weather proved very favorable, and time observations were always obtained very near to the time of arrival and departure of the steamer, so that the results are not dependent on the constancy of chronometer rates in any case for a longer period than fourteen hours.

The fourth round trip of the steamer was completed on the 7th of July, and the following day Mr. Morse dismounted and packed his instruments, and on July 17 sailed for San Francisco, the intervening time being occupied in finishing up the records and computations.

Mr. Morse arrived at San Francisco on July 20, and reported for duty at the suboffice.

ABSTRACT OF ANNUAL REPORTS FROM THE ASSISTANT IN CHARGE OF THE OFFICE, THE HYDROGRAPHIC INSPECTOR, AND THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES.

ABSTRACT OF THE ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE.

In Office Report No. 1 will be found the annual report of Mr. Andrew Braid, who served as assistant in charge of the office during the latter part of the fiscal year, his predecessor, Mr. B. A. Colonna, having resigned in March, 1895. Assistant Braid's report is accompanied by the annual reports of the various chiefs of divisions, and the details and statistics of the various operations of the office are fully set forth.

Assistant C. A. Schott, chief of the computing division, has attended as usual to the affairs of that division, and has made a number of special reports on the results of the computation of important field operations, among which may be mentioned those on the results of spirit leveling across the Peninsula of Florida, the geodetic results in the Mount St. Elias region, Alaska, and the results of the astronomical work in Alaska by the late Assistant J. H. Turner in 1889 and 1890. The important astronomical and trigonometrical work executed by Assistant J. E. McGrath, in connection with the Alaska boundary survey, is now being discussed and computed, and will soon be ready for the use of the State Department. A special study of the longitude system of the United States has been made with a view to supplying missing links necessary for its early completion.

The tidal division, under the charge of Acting Chief L. P. Shidy, has made satisfactory progress in the discussion and tabulation of tidal data, and owing to the great additional labor involved in the preparation for publication of the new and extended tide tables for the year 1896, it was found necessary to increase the force of the division temporarily by the detail of a number of field assistants. The regular force of the division also voluntarily worked overtime for a considerable period in order to expedite the preparation of the tables, and at the same time keep up to date the current work.

The reports of the drawing and engraving divisions have both been submitted by Assistant W. Ward Duffield, who assumed charge of the former on June 16, and of the latter on July 1, 1895, the two divisions being consolidated on the latter date. The general assignment of work in both divisions has been similar to that of previous years. During the year drawings were completed for 22 new charts to be photolithographed, and the drawings for 6 others are now in progress. The drawings of 43 charts were revised and corrected for new editions, and 85 for reprints. The usual number of diagrams, sketches, and illustrations for the report of the Superintendent were also drawn or revised; 20 topographic and 35 hydrographic projections were constructed for field parties, and 51 projections were made on copperplates; 21 field topographic sheets were inked and lettered. Fifty-seven calls for information from various Departments of the Government and from the public were received and attended to, many of them involving the preparation of drawings, tracings, or blue prints. A detailed list of these applications accompanies Assistant

Duffield's report. The engraved plates for 16 new charts, 23 for new editions and 7 for sketches and illustrations, have been completed, and a large number have been corrected and brought up to date; 28 basso and 35 alto plates have been completed in the electrotyping branch of the engraving division, and the usual number of photographs, blue, nigrosine, and silver prints have been made. The number of impressions from copperplates in the plate-printing department is given as 41 951.

The chart division has continued, as heretofore, under the direction of Assistant Gershom Bradford, and his report presents an interesting tabular comparison of the issue of charts during the present year and those of the previous six years. It appears that the total issue for 1895, viz, 51 456 charts, is a trifle smaller than for 1894, and 5 per cent less than the average of the six years, but this diminution is in the free distribution, as the net sales have increased 9 per cent over those of the previous year.

Mr. W. P. Ramsey succeeded Mr. M. W. Wines as chief of the miscellaneous division on August 31, 1894, and his report shows the number of the various publications of the Survey distributed and sold during the year, and the number of reports, appendices, Coast Pilots, bulletins, Tide Tables, and Notices to Mariners received from the Public Printer. Ten new agencies for the sale of charts and other publications were established during the year, eight on the Atlantic and Gulf coasts and two on the Pacific Coast, and four old ones were discontinued.

In the instrument division, Assistant J. F. Pratt succeeded Edwin Smith as chief on January 7, the latter being, at his own request, assigned to field duty. Assistant Pratt's report shows that very satisfactory progress has been made, and that a large amount of important work has been accomplished, both in the instrument and carpenter shops. The immediate direction of the work of the instrument makers has remained with the chief mechanician, Mr. E. G. Fischer.

Mr. H. Sidney King succeeded Mr. F. H. Parsons as chief of the library and archives division on the 21st of August, 1894, and his report shows the additions to the library during the year and the number of volumes of records and original topographical and hydrographic sheets received from the field officers of the Survey.

In the office of the assistant in charge, Mr. A. B. Simons rendered satisfactory service as executive and financial clerk, and Mr. E. B. Wills has continued to keep the leave of absence records and those of freight, express, and registered mail. Miss Kate Lawn and Miss Sophie Hein served as typewriters. Miss Ida M. Peck, early in the fiscal year, was transferred to the office of the disbursing agent, and served there for the rest of the year, excepting during the month of April, when she was temporarily detailed for special duty at the Treasury Department. Mr. W. B. Chilton continued his service as clerk in the Superintendent's office during the entire year.

ABSTRACT OF THE ANNUAL REPORT OF THE HYDROGRAPHIC INSPECTOR.

The assignment of Lieut. Commander Jeff. F. Moser, U. S. N., as hydrographic inspector, Coast and Geodetic Survey, was continued during the whole fiscal year. He has presented a very full report of the hydrographic work executed by the naval parties, under his direction, on the Atlantic, Gulf, and Pacific coasts, and in Alaska, and also submits the reports of the naval officer in charge of the hydrographic and coast pilot divisions of the office. His report is accompanied by statistical tables showing the results accomplished by each field hydrographic party and the number of officers attached to each vessel; a detailed statement of the repairs made to each vessel and the amounts expended therefor is also given.

The hydrographic inspector renews his recommendations of last year relative to the making of more extended current observations, the exploration of the Yukon River, in Alaska, and the survey of the Aleutian Islands. As the steamer *Hassler* is now unserviceable and condemned, a new steamer will be necessary for this purpose, and the immediate authorization by Congress for the building of such a steamer is strongly urged. The estimated cost of the new vessel is $125 000.

Lieutenant Commander Moser refers at length to the great loss sustained by the Survey and the naval service by the death of Lieut. F. H. Crosby, who lost his life in the performance of duty on the coast of Washington, as already mentioned elsewhere in this report. He speaks in the highest terms of his energy and skill and the valuable service rendered by him during the many years of his connection with the Survey.

The report of the hydrographic division, by its chief, Lieut. Walter McLean, U. S. N., shows that a large amount of work has been accomplished, and refers in complimentary terms to the zeal and efficiency of all the members of the division. Twenty-nine new hydrographic sheets have been drawn and platted, and the results of extensive resurveys have been platted on 24 old sheets. The work on these 53 original sheets involved the study and use of 228 volumes of records and the platting of 77 697 angles and 361 172 soundings. Ninety reduced drawings of hydrography have also been revised, verified, and corrected; the aids to navigation, including light tables, have been platted on charts, and 143 proofs of new issues have been revised, verified, and corrected; also a large amount of miscellaneous work, including the preparation of the monthly notices to mariners, comparison of old and new surveys, and the preparation of schemes for new surveys and resurveys. Lieutenant McLean also submits the report of the coast pilot division, which was under his charge from the beginning of the fiscal year to September 22, 1894, and again from June 21, 1895, to the close of the year. From September 22, 1894, to June 21, 1895, the division was under the charge of Lieut. Franklin Swift, U. S. N., who, at the latter date, was recalled by the Navy Department and assigned to sea duty.

During the year a new volume of the Coast Pilot, known as Part VII, and including the coast from Chesapeake Bay entrance to Key West, was completed and sent to the printer, and five supplements to previous volumes, embodying all corrections up to date, were also compiled.

Lieutenant McLean acknowledges the valuable assistance rendered by the various hydrographic parties in the field and by the commanding officers of the revenue cutters stationed along the parts of the coast covered by the volumes named. All the members of this division have also rendered very satisfactory service.

ABSTRACT OF THE ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES.

The charge of the Office of Standard Weights and Measures continued with Assistant O. H. Tittmann, but during the early part of the year, from July 1 to September 10, while he was engaged on field duty on the resurvey of Boston Harbor, the temporary charge of the division devolved on Mr. L. A. Fischer.

The annual report of the Office of Standard Weights and Measures is submitted by Assistant O. H. Tittmann, and is published in full as Office Report No. 4. It is accompanied by an abstract, in tabular form, of the verifications of weights and measures made during the year.

The regular force of this division remained unchanged during the year, and Assistant John F. Hayford was detailed for duty, under Assistant Tittmann's direction, from September 8, 1894, to June 4, 1895. He determined the densities and masses of the new X set of gramme weights; made a redetermination of the errors of the foot graduation of the United States bench standard, and investigated the behavior of the new balance of precision. A special report on this balance has been prepared by Mr. Hayford for publication. The elaborate and tedious preparation and adjustment of the State sets of weights for North and South Dakota were finally completed, and the sets were forwarded to their respective destinations in June, 1895. All the work of adjustment and verification of these standards devolved upon Mr. L. A. Fischer, who also gilded and adjusted the X set of gramme weights, and made four groups of direct comparisons between the "Committee metre" and the new "Prototype No. 21," with a view to determining finally their relations. Some additional comparisons, however, will be necessary before this relation can be considered as definitely and conclusively established.

SUPERINTENDENT'S OFFICE.

At the beginning of the fiscal year Superintendent T. C. Mendenhall was absent in Europe, and Hon. William H. Pugh, Commissioner of Customs, was designated by the President as Acting Superintendent, and served in that capacity until October 1, 1894. Dr. Mendenhall's resignation was accepted September 20, 1894, and the appointment of his successor, Gen. W. W. Duffield, the present incumbent, bears the same date.

Assistant Andrew Braid continued to serve as executive officer to the superintendent until

March 11, 1895, when he was detailed to act as Assistant in charge of the Office. He was duly appointed to that office by the honorable Secretary of the Treasury, April 11, 1895, and was also designated as the Assistant to perform the functions of the Superintendent during the latter's absence. From March 12, 1895, to the close of the year the responsible duties of executive officer were performed by Assistant E. D. Preston.

Assistant O. H. Tittmann continued, under the Superintendent's direction, in charge of the Office of Standard Weights and Measures, and, in addition, took charge of the preparation for publication and the editing of the annual reports and bulletins of the Survey.

Assistant George A. Fairfield, in addition to the duties described elsewhere, continued in charge of matters pertaining to State surveys until May 17, 1895, when he was relieved and directed to turn over to the executive officer all papers and data belonging thereto.

Mr. William B. Chilton served efficiently during the year as clerk to the Superintendent, and Martin Hensel as secretary until September 15, at which time his resignation took effect. Mr. John F. Renfro was appointed secretary February 1, 1895, and served to the close of the year.

SUBOFFICES.

Suboffice in Philadelphia.—Assistant R. M. Bache continued in charge of the suboffice in Philadelphia, but from July 1 to November 1, during Mr. Bache's absence on field duty (the resurvey of Boston Harbor), the office was temporarily closed. Mr. Bache, on his return from Boston, in addition to attending to the duties pertaining to the suboffice, completed and inked his topographic sheet of Hingham Harbor and vicinity. As usual, copies of the Coast and Geodetic Survey Charts, Tide Tables, annual reports, and other publications were supplied to officers on duty in the city representing the United States Engineer Corps, the Light-House Board, the branch hydrographic office of the Navy Department, etc.; also to the city engineer and surveyor, the Philadelphia Maritime Exchange, etc.

At the close of the fiscal year this suboffice was discontinued, not being deemed longer essential on account of its proximity to the main office at Washington.

Suboffice in San Francisco.—Assistant George Davidson continued in charge of the San Francisco suboffice during the year, and during brief absences was temporarily relieved by Assistant A. F. Rodgers. Mr. Davidson conferred with his colleagues in all matters relating to the work on the Pacific Coast; answered all calls for information, and aided the Alaska boundary parties in the preparations for their work. He attended as usual to the repairs of the instruments of the hydrographic parties, and forwarded to the Washington Office such instruments as were called for. He has also, with the assistance of Assistant Fremont Morse, continued necessary astronomical and magnetic observations, and superintended the running of the tidal stations at Sausalito and San Francisco, rendering monthly reports of the same and transmitting the records and computations to Washington. Other officers of the Survey, engaged on the Pacific Coast work, were from time to time detailed to the suboffice, either for the completion of their own records and computations or to assist in the work of the office.

Mr. Ferdinand Westdahl, draftsman, continued on duty as heretofore, and Mr. Frank W. Edmonds performed the clerical duties of the office. Mr. Vincent Denis, messenger and porter, performed his usual duties, attending also to the equipments, etc., of the Survey stored at the suboffice, and their receipts and transfers; he was also required to wind regularly the chronometer and astronomical clock at the Lafayette Park Observatory.

At the close of the fiscal year Assistant Davidson was relieved of the charge of the suboffice, and was succeeded by Assistant A. F. Rodgers.

UNITED STATES COAST AND GEODETIC SURVEY REPORT FOR 1895.

PART I.

FIELD AND OFFICE DETAILS.

TABULAR STATEMENTS AND ANNUAL OFFICE REPORTS.

TABLE No. 1–1895.

Distribution of the field parties of the Coast and Geodetic Survey upon the Atlantic, Gulf of Mexico, and Pacific coasts, and in the interior of the United States, during the fiscal year ending June 30, 1895.

I.—EASTERN DIVISION—STATES EAST OF THE MISSISSIPPI RIVER.

1. Maine.
2. New Hampshire.
3. Vermont.
4. Massachusetts.
5. Rhode Island.
6. Connecticut.
7. New York.
8. New Jersey.
9. Pennsylvania.
10. Delaware.
11. Maryland.
12. District of Columbia.
13. Virginia.
14. North Carolina.
15. South Carolina.
16. Georgia.
17. Florida.
18. Alabama.
19. Mississippi.
20. Michigan.
21. Wisconsin.
22. Ohio.
23. Indiana.
24. Illinois.
25. West Virginia.
26. Kentucky.
27. Tennessee.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Massachusetts	No. 1	Topography	H. L. Whiting, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	2	Topography	H. G. Ogden, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	3	Topography	O. H. Tittmann, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	4	Topography	R. M. Bache, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	5	Topography	C. H. Boyd, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	6	Topography	D. B. Wainwright, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	7	Topography	W. I. Vinal, assistant	Topographic resurvey of Boston Harbor and vicinity.
Massachusetts	8	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Hydrographic resurveys in Boston Bay from Cohasset to Scituate and in Broad Sound, Lynn Harbor, Saugus River, and Chelsea Creek; also from Nahant to Cat Island, including Marblehead Harbor; also special examinations of Tinkers Ledge and the shoal waters to the eastward of Tinkers Island.
Massachusetts	9	Hydrographic examinations.	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic examinations of reported dangers in Buzzards Bay.
Massachusetts	10	Topography	W. I. Vinal, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	11	Topography	D. B. Wainwright, assistant	Topographic resurvey of Buzzards Bay
Massachusetts	12	Topography	J. A. Flemer, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	13	Topography	Stehman Forney, assistant	Topographic resurvey of Buzzards Bay.
Massachusetts	14	Hydrography	Lieut. G. C. Hanus, U. S. N., assistant.	Hydrographic resurvey of New Bedford Harbor and approaches.
Massachusetts	15	Hydrography	Lieut. W. F. Low, U. S. N., assistant.	Hydrographic resurveys and special developments on the coast of Massachusetts, including the survey of Salem Harbor.
Massachusetts	16	Physical hydrography.	H. L. Marindin, assistant	Continuation of the physical hydrographic survey of the shores of Marthas Vineyard.
Massachusetts	17	Hydrography	Lieut. G. W. Mentz, U. S. N. assistant.	Completion of the hydrographic survey of Nantucket Sound.
Massachusetts	18	Town Boundary Survey.	Henry L. Whiting, assistant and Commissioner of the Massachusetts State Survey; C. H. Van Order, assistant.	Continuation of the determinations of town boundaries in the State.
Rhode Island	19	Hydrography	Lieut. L. M. Garrett, U. S. N. assistant.	Hydrographic surveys and special hydrographic examinations in Narragansett Bay and vicinity.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued

I.—EASTERN DIVISION—STATES EAST OF THE MISSISSIPPI RIVER—Continued.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Rhode Island	20	Tidal observations	David Hamilton, observer under the supervision of officers of the U. S. Engineer Corps.	Tidal observations at the automatic tide-gauge station at Newport. The station was discontinued February 7, 1895.
New York	21	Hydrographic examinations.	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic examinations in Long Island Sound, and establishment of range signals for the naval speed-trial course.
New York	22	Topography	C. T. Iardella, assistant	Continuation of the topographical resurvey of the south shore of Long Island.
New York	23	Tidal observations	J. G. Spaulding, tidal observer	Continuation of tidal record at the automatic tidal station at Fort Hamilton, New York Harbor.
New York	24	Tidal observations	Officers of the U. S. Corps of Engineers.	Continuation of tidal record at the automatic tidal station at Willets Point.
New York	25	Topography and triangulation.	John W. Donn, assistant	Continuation of the topographical survey of the Hudson River north of Newburg.
New York	26	Topography	W. C. Hodgkins, assistant	Continuation of the topographical survey of the Hudson River.
New York	27	Leveling	C. H. Van Orden, assistant	Line of levels run from Greenbush to Dobbs Ferry.
New York	28	Geodetic operations	Prof. E. A. Bowser, acting assistant; G. A. Fairfield, assistant in charge of State surveys.	Advance of reconnaissance and triangulation in the southwestern part of the State.
Delaware	29	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Resurvey of Delaware breakwater anchorage.
District of Columbia	30	Tidal observations	Tidal Division, U. S. Coast and Geodetic Survey Office.	Continuation of the automatic tidal record at the navy-yard.
Virginia	31	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic examinations, in Chesapeake Bay, near the mouth of York River, etc.
Virginia	32	Precise leveling	Isaac Winston, assistant	Line of precise leveling, run from Richmond, Va., to Washington, D. C.
South Carolina	33	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic resurvey of Charleston Harbor and its approaches.
South Carolina	34	Topography	John W. Donn, assistant	Completion of the topographic resurvey in the vicinity of Charleston.
South Carolina, Georgia, Virginia, New Jersey, and Massachusetts.	35	Magnetic observations.	J. B. Baylor, assistant	Magnetic determinations at Charleston, Savannah, Cape Henry, Sandy Hook, and Nantucket.
Florida	36	Hydrographic examinations.	Lieut. Robert G. Peck, U. S. N., assistant.	Hydrographic examination of Charlotte Harbor entrance and search for a reported shoal.
Florida	37	Hydrographic examinations.	Lieut. Robert G. Peck, U. S. N.	Hydrographic examination of Palatine Shoal off Tampa Bay.
Florida	38	Topography	P. A. Welker, assistant	Completion of the topographic resurvey of Pensacola Bay and its tributaries.
Florida	39	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Continuation of the hydrographic resurvey of Pensacola Bay and its tributaries.
Alabama	40	Triangulation	F. W. Perkins, assistant	Signal building for the triangulation of the oblique arc.
Indiana	41	Astronomical	G. R. Putnam, assistant	Laying out a true meridian line at Terre Haute.
Kentucky and Tennessee.	42	Geodetic	Prof. A. H. Buchanan, acting assistant; G. A. Fairfield, assistant in charge of State surveys.	Continuation of the triangulation of Tennessee toward a junction with the primary work lying between the Maryland and Georgia base lines.
Maryland, Ohio, Indiana, Illinois, and District of Columbia.	43	Gravity determinations.	G. R. Putnam, assistant	Relative gravity determinations, with half-second pendulums, at Deer Park, Md.; Cleveland, Ohio; Cincinnati, Ohio; Terre Haute, Ind.; Chicago, Ill.; and Washington, D. C. (For other stations, see Middle and Western Divisions.)

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

II.—MIDDLE DIVISION—STATES AND TERRITORIES BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

28. Minnesota.
29. North Dakota.
30. South Dakota.
31. Iowa.
32. Nebraska.
33. Missouri.
34. Kansas.
35. Arkansas.
36. Indian Territory.
37. Oklahoma Territory.
38. Louisiana.
39. Texas.

State or Territory.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Minnesota	No. 44	Topography and triangulation.	W. C. Hodgkins, assistant; G. A. Fairfield, assistant in charge of State surveys.	Continuation of the geodetic work and topography in the vicinity of Minneapolis and St. Paul.
Missouri and Kansas	45	Gravity observations.	G. R. Putnam, assistant	Determinations of relative gravity at St. Louis, Kansas City, Ellsworth, and Wallace.
Missouri and Arkansas.	46	Precise leveling	Isaac Winston, assistant	Double line of precise levels run from Lamar, Mo., to Chester, Ark.
California, New Mexico, Texas and Louisiana.	47	Telegraphic longitude determinations.	C. H. Sinclair, assistant; Edwin Smith, assistant; A. T. Mosman, assistant; G. R. Putnam, assistant.	Telegraphic longitude determinations at Needles, Cal.; Santa Fe, N. Mex.; El Paso, Tex.; Austin, Tex.; Galveston, Tex.; New Orleans, La.; and Laredo, Tex., with incidental latitude, magnetic and gravity determinations.
Texas	48	Astronomical	G. R. Putnam, assistant	Latitude determination at Laredo.
Texas	49	Magnetic	Edwin Smith, assistant	Magnetic determinations at El Paso, Austin, Laredo, and Galveston.
Texas	50	Gravity determinations.	G. R. Putnam, assistant	Determinations of relative gravity at Laredo, Galveston, and Austin.
Texas	51	Reconnoissance	Stehman Forney, assistant	Completion of the reconnaissance for a scheme of triangulation from El Paso to the Gulf of Mexico.
Texas	52	Magnetic	L. G. Schultz, observer; R. E. Halter, assistant.	Completion of the magnetic record at the observatory at Hillside Ranch near San Antonio.

III.—WESTERN DIVISION—STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC.

40. California.
41. Oregon.
42. Washington.
43. Idaho.
44. Montana.
45. Wyoming.
46. Nevada.
47. Utah Territory.
48. Colorado.
49. Arizona Territory.
50. Territory of New Mexico.

States or Territories.	Parties.	Operations.	Persons conducting operations.	Localities of work.
California	No. 53	Topography	A. F. Rogers, assistant	Topographical resurvey of San Francisco Bay and Harbor.
California	54	Hydrography	Lieut. Lucian Flynne, U. S. N., assistant.	Hydrographic resurvey of San Francisco Bay and Harbor.
California	55	Hydrography	Lieut. Jas. H. Sears, U. S. N., assistant.	Hydrographic resurvey of San Francisco Bay and Harbor.
California	56	Tidal observations	Emmet Gray, observer, under the supervision of George Davidson, assistant.	Continuation of the tidal record at Sausalito Tidal Station.
California and New Mexico.	57	Telegraphic longitude determinations.	C. H. Sinclair, assistant; Edwin Smith, assistant.	Telegraphic determinations of differences of longitude at Needles and Santa Fe. (For other stations, see Middle Division.)
California	58	Astronomical	C. H. Sinclair, assistant	Latitude determination at Needles.
California and New Mexico.	59	Magnetic	Edwin Smith, assistant	Determination of the magnetic elements at Needles and Santa Fe.
California and Nevada.	60	Magnetic	C. H. Sinclair, assistant	Determination of the magnetic elements at Lake Tahoe and Carson City.
Oregon and Washington.	61	Magnetic	J. J. Gilbert, assistant	Determination of the magnetic elements at Portland, Cape Disappointment, Vancouver, Port Townsend, Seattle, and Tacoma.
Washington	62	Hydrography	Lieut. Lucian Flynne, U. S. N., assistant.	Hydrographic surveys in Washington Sound and Strait of Juan de Fuca.
Washington	63	Triangulation and topography.	J. J. Gilbert, assistant	Continuation of the triangulation and topography of Washington Sound.
Washington	64	Hydrography	Lieut. F. H. Crosby, U. S. N., assistant; Lieut. James H. Sears, U. S. N., assistant.	Hydrographic surveys off the coast from Grays Harbor to the Quillayute River.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

III.—WESTERN DIVISION—STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC—Continued.

States or Territories.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Washington	65	Hydrography	Lieut. G. B. Harber, U. S. N., assistant.	Hydrographic examination of the water front and harbor of Tacoma to determine changes caused by the landslide of November, 1894.
Colorado, Wyoming, and Utah.	66	Gravity determinations.	G. R. Putnam, assistant	Gravity determinations at Denver, Colorado Springs, Pikes Peak, Gunnison, Grand Junction, Grand Canyon, Norris Geyser Basin, Lower Geyser Basin, Salt Lake City, Green River and Pleasant Valley Junction.
Colorado	67	Meridian line determination.	G. R. Putnam, assistant	Laying out of a meridian line at Colorado Springs.
Colorado	68	Geodetic	William Eimbeck, assistant	Continuation of the transcontinental triangulation.
Colorado	69	Geodetic	F. D. Granger, assistant	Continuation of the transcontinental triangulation.
Colorado	70	Geodetic	F. W. Perkins, assistant	Continuation of the transcontinental triangulation.
Colorado	71	Geodetic	P. A. Welker, assistant	Continuation of the transcontinental triangulation.

IV.—THE DIVISION OF ALASKA, INCLUDING ITS COASTS BORDERING ON THE PACIFIC OCEAN, ON BERING SEA, AND ON THE ARCTIC OCEAN; ALSO ITS INLETS, SOUNDS, BAYS, RIVERS, AND THE ALEUTIAN AND PRIBILOF ISLANDS.

Territory.	Parties.	Operations.	Persons conducting operations.	Localities of work.
Southeastern Alaska	No. 72	Hydrography and general surveys.	Lieut. Commander W. I. Moore, U. S. N., assistant.	Survey of Chatham Straits from Point Augusta to Point Samuel, the west end of Kenasnow Island, and Freshwater Bay, Tenakee Inlet (Siwash Passage), and the north end of Hood's Bay, including Killisnoo Harbor.
Southeastern Alaska	73	Hydrography and general surveys.	Lieut. Commander E. K. Moore, U. S. N., assistant.	Resumption of the hydrographic and general surveys in southeastern Alaska in the spring of 1895. Localities of work, Chatham Straits, Hootznahoo (or Kootznahoo) Inlet, and Peril Strait. The *Patterson* also carried the civilian parties for the boundary survey and landed them at their respective stations.
Southeastern Alaska	74	Topographic sketching and transportation of chronometers.	Lieut. G. B. Harber, U. S. N., assistant.	Transportation of chronometers between Sitka and Pyramid Harbor for the determination of difference of longitude, both astronomical stations being in charge of civilian assistants engaged on the Alaska boundary.
Southeastern Alaska	75	Tidal observations	Fremont Morse, assistant	Completion of the series of tidal observations at Sitka.

The names of chiefs of parties engaged in the Alaska boundary work, and the localities of their surveys, will be found under the heading of "Special operations."

SPECIAL OPERATIONS.

States or Territories.	Parties.	Persons conducting operations.	Localities of work.
New York	No. 76	H. G. Ogden, assistant	Determination of geographical positions for the establishment of a speed-trial course for naval vessels in Long Island Sound. Survey made at the request of the honorable Secretary of the Navy.
District of Columbia	77	E. D. Preston, assistant	Establishment of the Naval Observatory Circle, radius 1 000 feet. Survey made by authority of a joint resolution of Congress, approved August 1, 1894.
Virginia	78	W. C. Hodgkins, assistant	Special survey of the Fox islands, Chesapeake Bay, for the determination of acreage included between high and low water lines. Survey made at the request of the State authorities.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

SPECIAL OPERATIONS—Continued.

States or Territories.	Parties.	Persons conducting operations.	Localities of work.
Virginia	79	J. B. Baylor, assistant	Completion of the surveys for the State of Virginia for the mapping of the natural oyster beds.
Alabama	80	H. P. Ritter, observer	Completion of the survey of the oyster grounds of Mobile Bay and vicinity for the United States Commission of Fish and Fisheries.
California	81	A. T. Mosman, assistant, and member of the Boundary Commission.	Continuation of the operations of the International Boundary Commission for the relocation and marking of the boundary line between the United States and Mexico, from El Paso to the Pacific Ocean.
California and Nevada.	82	C. H. Sinclair, assistant, and W. B. Fairfield, assistant.	Continuation of the survey of the oblique boundary between California and Nevada.
Washington	83	J. J. Gilbert, assistant	Special topographic and hydrographic survey of the vicinity of Port Orchard at the request of the honorable Secretary of the Navy.
Southeastern Alaska	84	Fremont morse, assistant	*Alaska Boundary Survey.*—Occupation of the Sitka astronomical station for time observations and chronometric exchanges with Pyramid Harbor astronomical station for the determination of the longitude of the latter.
Southeastern Alaska	85	J. E. McGrath, assistant	*Alaska Boundary Survey.*—Survey from the south end of Malaspina Base to the Yahtse River, and determination of points near Lituya Bay.
Southeastern Alaska	86	J. F. Pratt, assistant	*Alaska Boundary Survey.*—Triangulation and topographic reconnaissance of Chilkat and Taiya inlets.
Southeastern Alaska	87	J. A. Flemer, assistant	*Alaska Boundary Survey.*—Topographic reconnaissance to the northward and eastward of Taiya Inlet and River.
Southeastern Alaska	88	H. P. Ritter, expert observer	*Alaska Boundary Survey.*—Topographic reconnaissance to the northward and westward of Chilkat Inlet and River.
Southeastern Alaska	89	E. F. Dickins, assistant	*Alaska Boundary Survey.*—Topographic reconnaissance on Chilkat and Chilkoot inlets.
Southeastern Alaska.	90	E. F. Dickins, assistant	*Alaska Boundary Survey.*—Astronomical observations at Marys Island, and triangulation between that point and Port Simpson, in the spring of 1895.
Southeastern Alaska	91	P. A. Welker, assistant	*Alaska Boundary Survey.*—Astronomical observations at the head of Portland Canal and trigonometric survey of Portland Canal.
Southeastern Alaska and Washington.	92	F. A. Young, assistant	*Alaska Boundary Survey.*—Transportation of chronometers to and fro between the astronomical station in Seattle, and the Alaskan astronomical stations, for longitude determinations.
Washington	93	Fremont Morse, assistant	*Alaska Boundary Survey.*—Occupation of the Seattle astronomical station for the chronometric determination of Alaskan longitudes.
British Columbia	94	O. B. French, aid	*Alaska Boundary Survey.*—Astronomical observations at Port Simpson.

At the close of the astronomical work the various parties of 1895 were consolidated, under the direction of Assistants E. F. Dickins and P. A. Welker, for the execution of the triangulation.

TABLE No. 2–1895.

Statistics of field and office work of the Coast and Geodetic Survey for the fiscal year 1895, and total to June 30, 1895.

	Total to June 30, 1894.	During fiscal year 1895.	Total to June 30, 1895.
RECONNAISSANCE.			
Area in square statute miles	445 710	11 700	457 410
Parties, number of	....	3	....
BASE LINES.			
Primary, number of	16	....	16
Primary, length of, in statute miles	105	....	105
Subordinate, number of	159	7	166
Subordinate and beach measures, length of	578	81	659
TRIANGULATION.			
Area in square statute miles	306 310	7 760	314 070
Stations occupied for horizontal measures, number of	14 280	469	14 749
Geographical positions determined, number of	26 988	776	27 764
Stations occupied for vertical measures, number of	1 073	21	1 094
Elevations determined trigonometrically, number of	2 638	29	2 667
Heights of permanent bench marks by spirit leveling, number of	974	39	1 013
Lines of spirit leveling, length of, in statute miles	4 791	152	4 943
Triangulation and leveling parties, number of	....	22	....
ASTRONOMICAL WORK.			
Azimuth stations, number of	251	8	259
Latitude stations, number of	405	12	417
Longitude stations, telegraphic, number of	173	*6	174
Longitude stations, chronometric or lunar, number of	119	3	122
Astronomical parties, number of	....	10	....
MAGNETIC WORK.			
Stations occupied, number of	995	87	1 082
Magnetic observatories occupied, number of	5	†2	5
Magnetic parties, number of	....	8	....
GRAVITY MEASURES.			
Home stations occupied, number of	30	24	54
Foreign stations occupied, number of	28	....	28
Parties, number of	....	1	....

* Five old stations. † Old stations.

Statistics of field and office work of the Coast and Geodetic Survey—Continued.

	Total to June 30, 1894.	During fiscal year 1895.	Total to June 30, 1895.
TOPOGRAPHY.			
Area surveyed, in square statute miles	37 801	*246	380 47
Length of general coast, in statute miles	11 137	121	11 258
Length of shore line, in statute miles, including rivers, creeks, and ponds	99 345	434	99 779
Length of roads, in statute miles	49 300	1 110	50 410
Topographical parties, number of	....	14	....
HYDROGRAPHY.			
Parties, number of, in charge of naval officers	....	13	....
Parties, number of, in charge of civilian officers	....	1	....
Number of miles (geographical) run while sounding	498 204	9 277	507 481
Area sounded, in square geographical miles	159 684	1 604	161 288
Miles run, additional, of outside or deep-sea soundings	92 955	....	....
Number of soundings	21 838 388	451 044	21 834 932
Deep-sea soundings	13 270	....	13 270
Deep-sea temperature observations	17 955	....	17 955
Current stations, number of, occupied by hydrographic parties	....	27	....
Deep-sea current stations, number of	....	....	....
Deep-sea subcurrent observations, number of	....	....	....
Deep-sea surface current observations, number of	....	....	....
Specimens of bottom, number of	14 015	33	14 048
Automatic tide gauges established	105	3	108
Automatic tide gauges discontinued	99	4	103
Parties doing tidal work exclusively	....	2	....
Parties doing tidal work in connection with hydrographic work	....	13	....
Staff and box gauges established	2 309	43	2 352
Staff and box gauges discontinued	2 305	47	2 352
RECORDS.			
Tidal and current observations, originals, number of vols.	5 110	88	5 198
Tidal and current observations, duplicates, number of vols.	3 397	64	3 461
Aggregate years of record for automatic tide gauges	311	6	317
Tidal stations for which reductions have been made	1 655	57	1 712
Aggregate years of record reduced	328	13	341
Triangulation, originals, number of volumes	6 660	153	6 813
Triangulation, originals, number of cahiers	....	7	24
Astronomical observations, originals, number of volumes	2 206	33	2 239
Astronomical observations, originals, number of cahiers	....	2	6
Magnetic observations, originals, number of volumes	697	1	698
Magnetic observations, originals, number of cahiers	....	52	117
Pendulum observations, originals, number of volumes	....	10	22
Duplicates of above, number of volumes	7 346	227	7 573
Duplicates of above, number of cahiers	....	56	110
Geodetic leveling observations, number of vols., originals	....	40	88

*Not including topographical reconnaissance and special examinations in Alaska, which extended over an approximate area of 1 850 square miles.

Statistics of field and office work of the Coast and Geodetic Survey, etc.—Continued.

	Total to June 30, 1894.	During fiscal year 1895.	Total to June 30, 1895.
RECORDS—continued.			
Geodetic leveling observations, number of vols., duplicates	....	62	89
Computations, number of volumes	4 382	13	4 395
Computations, number of cahiers	....	233	500
Hydrographic soundings and angles, originals, number of volumes	12 747	213	12 960
Hydrographic soundings and angles, duplicates, number of volumes	4 294	189	4 483
MAPS AND CHARTS.			
Topographic maps, originals	2 169	29	2 198
Hydrographic charts, originals	2 392	26	2 418
ENGRAVING.			
Engraved plates of charts	554	48	602
Engraved plates of preliminary charts and diagrams for the Coast and Geodetic Survey reports, and of maps of the District of Columbia	854	13	867
Engraved plates of Coast Pilot charts	80	....	80
Engraved plates of Coast Pilot views	104	....	104
Electrotype plates made	2 425	61	2 486
PRINTING.			
Sheets of charts and maps deposited with sale agents	480 338	25 635	505 973
Sheets of charts and maps sold at Coast and Geodetic Survey Office	....	929	....
Sheets of charts and maps distributed to Congress, Executive Departments, foreign Governments, libraries, etc.	....	24 892	....
Sheets of charts and maps, total distribution	994 949	51 456	1 046 405

TABLE No. 3–1895.

Information furnished to Departments of the Government in reply to special requests, and to individuals upon application, during the fiscal year ending June 30, 1895.

Date.	Name.	Data furnished.
1894.		
July 2	P. Julian Latham, C. E., Orange Springs, Fla	Magnetic declination about 1833-1835 in Marion County, Fla.; probable change since, and present annual change.
2	U. S. Geological Survey, Washington, D. C	Geographical positions of three stations in Vermont and description of a station in the same State.
2	A. L. Corthell, C. E., 71 Broadway, New York	Description of three bench marks and tidal information.
7	F. M. Eppley, New York	Geographical positions and descriptions of stations in the vicinity of Hell Gate, New York Harbor.
9	H. N. Ogden, Woodford, Me	Geographical positions and descriptions of stations in the vicinity of Portland, Me.
10	J. A. Ockerson, principal assistant engineer of the Mississippi River Commission.	Appendices Nos. 7 and 14 of Coast and Geodetic Report for 1887, in reply to request for information.
10	W. B. Edwards, Enido, Ky	Change of magnetic declinations in Boyle County, Ky., between 1836 and 1894, and present annual decrease of each declination.
12	M. Taylor, Hill Station, Va	Three publications on magnetic declination, in reply to request for information on the subject.
16	J. W. Chickering, Ripton, Vt	Elevation of Potato Hill Station above mean sea level.
16	Dr. Th. Albrecht, Potsdam, Germany	Results of observations made at San Francisco and other stations for the determination of the variation of latitude.
18	Randal Hagner, Washington, D. C	Tidal data relating to the Washington, D. C., Navy-Yard.
18	W. W. Austen, Winchester, Ky	Formula for computing sunrise and sunset.
21	W. M. Fraser & Co., surveyors, Altoona, Pa	Information in regard to a meridian line established at Altoona, Pa., and three appendices on terrestrial magnetism.
25	U. S. Commission of Fish and Fisheries, Washington, D. C.	Descriptions of trigonometric stations on the St. Croix River, Maine.
25	W. W. Austen, Winchester, Ky	Explanation of tide tables and of the formation of a table of semi-diurnal arcs.
25	H. B. Whitcom, Richmond, Va	Mean tidal level in tidal rivers.
26	F. F. B. Coffin, Huron, S. C	Information respecting the earth's figure in connection with its rotation.
26	W. Kaucher, Oregon, Mo	Geographical positions, distances, angles, and azimuths of six stations of the secondary triangulation of the Missouri River.
26	J. F. Noble, Trenton, N. C	Magnetic declination at Newbern, N. C., between the years 1770 and 1900.
27	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of trigonometric stations in California.
7	Lucien Minor, Galveston, Tex	Depths of water at the entrances of the principal ports of the United States and also at Havre, France, and Liverpool, England.
16	Lieut. Geo. A. Trim, U. S. E	Two blue prints made from special tracing of original hydrographic sheet No. 1325—Cubits Crevasse Mississippi River.
31	Dr. F. R. Helmert, International Geodetic Association, Berlin, Germany.	Diagrams of the variation of latitude at San Francisco, according to observations of 1891-92; also variation according to Chandler's formula, at San Francisco, Cal.; Waikiki, Hawaiian Islands; Rockville, Md., and Berlin, Germany.
	Dr. B. A. Gould, Cambridge, Mass	Diagrams showing the variation of latitude at San Francisco, Cal., according to the observations of 1891 and 1892; also the variation according to Chandler's formula at San Francisco, Cal.; Waikiki, Hawaiian Islands; Rockville, Md., and Berlin, Germany.
	Col. Geo. Defforges, Paris, France	Diagrams showing the variation of latitude at San Francisco, Cal., according to the observations of 1891 and 1892; also the variation according to Chandler's formula at San Francisco, Cal.; Waikiki, Hawaiian Islands; Rockville, Md., and Berlin, Germany.
18	Capt. B. A. Fahm, Brunswick, Ga	Information concerning St. Simons Entrance, Georgia, and blue print from our latest survey.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
July 19	Henry N. Ogden, city engineer, Deering, Me	Tracings of sketches of trigonometric stations east of Saco River, Maine, work of 1850–1852, and stations in the vicinity of Portland, Me., work of 1868–69.
25	Capt. H. C. Taylor, president of Naval War College, Newport, R. I.	Maps of the eastern end of Long Island Sound, mounted and colored, with shore line strengthened, etc.
28	Wm. C. Murdock, secretary Fish Commission, San Francisco, Cal.	Length of general coast line, coast line of the mainland, coast line of the mainland and islands, and coast line of the islands, of the States bordering on the Atlantic and Gulf coasts of the United States.
Aug. 3	J. E. Emery, New Haven, Conn	Elevations in Vermont; appendix No. 7, United States Coast and Geodetic Survey Report of 1887; references to heights.
3	H. A. Gill, Acting Commissioner of Fish and Fisheries	Descriptions of two trigonometrical stations, their geographical positions, distances, and azimuths.
7	Lieut. M. M. Macomb, U. S. A., Washington, D. C	Length of base line near Fort Myer.
7	B. F. Haynes, Marion, Ind	Change in magnetic declination in Somerset County, Md., between the years 1721 and 1894.
9	S. B. McKee	Geographical positions of two light-houses on Lake Champlain; revised position of station Bald Peak of the Adirondack survey.
10	R. W. Morris, West Point, N. Y	Geographical positions of two trigonometric points.
16	L. M. Haupt, Philadelphia, Pa	Geographical positions and descriptions of trigonometric stations between the Delaware and Raritan rivers; Appendix No. 11 of United States Coast and Geodetic Survey Report of 1882, on spirit levels in the same region.
17	Prof. Dwight Porter, Institute of Technology, Boston, Mass.	Sea-water temperatures in Boston Harbor during the year 1893.
20	J. H. Cummings, Talmage, Mo	Elevation of the St. Louis bench mark above mean sea level.
21	F. N. Cole, University of Michigan, Ann Arbor, Mich	Latest information respecting the secular variation of the magnetic declination; tables of variations corrected to date; table of annual change for 1890–1895, and 1900, arranged by States and Territories; tables of times of culminations and elongations of Polaris between the years 1889 and 1910.
22	W. C. Bristol, South Bend, Wash	Descriptions of three bench marks, and tidal information.
31	O. D. Wheeler, St. Paul, Minn	Height of Mount Ranier, Washington.
6	Henry Woodward, Middletown, Conn	Distances on the Connecticut River between the bridge at Middletown and Hartford.
13	Lieut. Spencer Crosby, U. S. E., assistant engineer fourth light-house district.	Tracings of hydrographic sheets Nos. 1504*a* and 1504*b* and parts of topographic sheets Nos. 1547*a* and 1550, vicinity of Reedy Island, Delaware River.
22	C. A. Corliss, C. E., Bath, Me	Tracing of McMahons Island, Sheepscott River, Me., from original topographic sheet.
27	F. M. Eppley, 140 Nassau street, New York	Tracing of shore line of East River in the vicinity of Stony Point from topographic surveys of 1837, 1855, and 1885, and hydrographic survey of 1837.
30	W. F. King, Canadian Commissioner on Alaskan and northeast boundaries, Ottawa, Canada.	Chart showing the Coast and Geodetic Survey triangulation of Lynn Canal, Alaska.
30	Capt. T. W. Symons, U. S. E., Portland, Oreg	Tracing of the hydrography of Clallam Bay, Straits of Fuca, from original hydrographic sheet.
Sept. 1	C. A. Denton, Board of Education, Butler, Mo	Elevation of Coast and Geodetic Survey bench mark at Butler, Mo., above mean sea level.
4	M. D. Gravatt, B. S., Manalapan, N. J	Information concerning terrestrial magnetism—three appendices.
6	John Baily & Co., Philadelphia, Pa	Explanation of Tide Tables.
7	E. A. Giesler, Savannah, Ga	High and low waters at 14 stations on the Hudson River and approaches.
7	Maj. Thos. H. Handbury, U. S. E	Tides at Cape Canaveral, Florida.
8	J. Atwell, Mitchells Station, Va	Table of secular variation of the magnetic declination for 1750 and two pamphlets on terrestrial magnetism.
10	Maj. Thos. H. Handbury, U. S. E	Geodetic data for the vicinity of Cape Canaveral, Florida.
11	H. W. Swasey, Portland, Me	Height of Black-strap Hill.
11	G. W. Hayes, C. E., Lebanon, Pa	Three appendices and one bulletin relating to magnetic declinations.
11	A. P. Killington, Cedar Springs, Va	Three appendices on magnetic declination.
15	G. W. Hayes, C. E., Lebanon, Pa	Information relative to the determination of the azimuth of Polaris.
15	J. G. Gholson, Broughton, Ill	Information relative to the moon's position when the tide wave begins in the Pacific Ocean; the effect of mountain masses upon the mean sea level.
17	E. A. Doyle, New York	Geographical positions of 24 stations on the north side of Long Island.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
Sept. 19	W. A. Gathright, Dabneys, Va	Times of high water at Savannah and Savannah entrance for October 1, 1894.
20	G. W. Hayes, C. E., Lebanon, Pa	Table and formulæ for computing the azimuth of a polar star for any hour angle, and latitude.
19	Lieut. M. L. Walker, U. S. E., Willets Point, N. Y	Instructions relative to management of a tide gauge.
20	B. Erickson	Descriptions and geographical positions of 17 trigonometrical points on Long Island, N. Y.
20	A. B. Warren, Richmond, Va	Appendices 7 of Report for 1888 and 11 of Report of 1889.
27	Commander C. S. Sigsbee, U. S. N., Hydrographic Office, Washington, D. C.	Descriptions and geographical positions of 56 trigonometric points in New York, Connecticut, New Hampshire, and Maine.
28	J. O. Andrews, Gainesville, Fla	Height of Gainesville and Hawthorn above mean sea level.
28	G. & C. Merriam and Company	Geographic position of Mount St. Elias, and information concerning the boundary line between Alaska and British Columbia.
1	Chief of Engineers, U. S. A	Tracings of Richs and Agate passages, Puget Sound, from original topographic and hydrographic sheets.
10	R. H. Brown, assistant engineer of the Delaware and Hudson Canal Company.	Tracing from original sheets of Lake Champlain, vicinity of Fort Ticonderoga.
15	Capt. H. C. Taylor, U. S. Naval War College, Newport, R. I.	Tracing of topography of Robbins, Gardiners, Shelter, and Plum islands, east end of Long Island Sound, from original sheets.
18	Thompson and Slater, Washington, D. C	Tracings of Homasassa River and Withlacoochie River, Florida, from original hydrographic sheets.
19	Maj. Thos. H. Handbury, U. S. E	Tracing of hydrography in the vicinity of Cape Canaveral, Florida, from original sheets.
21	Capt. T. W. Symons, U. S. E	Tracing of topography on the coast of Washington from original sheet No. 1788.
24	Col. W. P. Craighill, U. S. E	Tracing of hydrography in the vicinity of Tilghmans Point, Chesapeake Bay, from original sheets.
26	John H. Fountain, Crisfield, Md	Platting of the boundary line between Maryland and Virginia on Chart No. 133.
28	Lieut. Geo. A. Trim, U. S. E	Copy of topographical sheet of the survey of Cubit's Gap, Mississippi River.
Oct. 2	H. B. Bradford, Wilmington, Del	Information concerning terrestrial magnetism generally, and the present annual change of declination in Cecil County, Md.
10	H. F. Gunnison, editor of the Eagle Almanac, Brooklyn, N. Y.	Predicted tides for the year 1896 at Governors Island, N. Y.
11	O. W. Guerdrum, Topographic Office of Post-Office Department.	Positions of astronomical stations in Georgia.
12	Prof. Leonard S. Smith, University of Wisconsin	Information concerning refraction and unsteadiness of the atmosphere in connection with telemeter work.
15	W. H. Knight, Los Angeles, Cal	Information concerning magnetic observations at Los Angeles during a period of seven years.
16	A. J. Johnson, Baltimore and Ohio Railroad	Copy of Appendix No. 11 of Report of 1881, on result of spirit leveling.
19	G. B. Stovall, jr., Atlanta, Ga	Appendices relating to magnetic declinations in Georgia, during the years 1894 and 1895.
27	Lieut. C. C. Marsh, U. S. N., U. S. Naval Observatory, Washington, D. C.	Eight appendices relating to magnetic observation and results of the United States Coast and Geodetic Survey.
29	U. S. Light-House Board, U. S. Treasury Department, Washington, D. C.	Magnetic chart (isogonic), region of the Great Lakes, for the epoch 1895.
29	J. C. Russell, Ann Arbor, Mich	Heights and geographical positions of Mount St. Elias and Mount Logan, Alaska.
29	A. S. Christie, Washington, D. C	Copies of three communications on the subject of latitude variations.
30	A. M. Spear, Gardiner, Me	Data relating to the Coast and Geodetic Survey bench mark at Gardiner, Me.
30	The Funk & Wagnalls Publishing Company, New York	Heights and geographical positions of Mount St. Elias and Mount Logan.
31	J. J. Knoch, Arkansas Industrial University	Elevation of bench mark at Fayetteville Industrial University above mean sea level.
1	Colonel Mendell, U. S. E., San Francisco, Cal	Tracing of hydrography in the vicinity of certain rocks and dangers in San Francisco Bay and approaches, from original sheets.
3	J. Lyon, Interior Department, Washington, D. C	Tracing of country between Lakes Pontchartrain and Maurepas, Louisiana.
5	Geo. Davidson, San Francisco, Cal	Tracing of topography and hydrography from Cayucos Landing to Estero Point, from original sheets.
5	Capt. T. W. Symons, Portland, Oreg	Tracing of hydrography of entrance to Grays Harbor, from original sheets of the 1891 survey.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
Oct. 11	Maj. Thos. H. Handbury, U. S. E	Tracing of hydrography in the vicinity of Cape Canaveral, Florida, from original sheets.
12	Maj. Charles E. R. B. Davis, U. S. E	Tracing of hydrography of Quantico Creek, Ware River, and Harris Creek, Virginia, from original sheets.
13	W. F. King, Canadian Boundary Commissioner, Ottawa, Canada.	Sketch of Coast and Geodetic Survey triangulation in Alaska, platte on Charts Nos. 8100, 8200, and 8300.
20	James P. Bogart, State Commission of Fish and Fisheries, New Haven, Conn.	Tracing of topography of Bridgeport and vicinity, from original sheets.
26	Wm. Jackson, C. E., city engineer of Boston, Mass	Tracing of hydrography of the flats off East Boston, from original sheets.
Nov. 2	J. P. N. Bell, Gainesville, Fla	Latitude, longitude, and elevation above mean sea level of the bench mark at Gainesville, Fla.
2	C. M. Gulde, West Point Pleasant, N. J	Geographical position of S. Osborn; ratio of metric and British units of weight and measure; dimensions of the earth adopted by the United States Coast and Geodetic Survey.
5	A. A. Schenck, chief assistant engineer of the New York Central and Hudson River Railroad.	Information concerning results of spirit leveling; half-tide level of the ocean and New York Harbor; descriptions of 4 bench marks at Jersey City and Governors Island.
5	A. M. Ford, Salem, N. J	Explanation of Tide Tables for 1895.
8	Lieut. A. Slaker, U. S. A., David Island, N. Y	Geographical positions of 8 trigonometric points in the vicinity of David Island.
12	W. and L. E. Gurley, Troy, N. Y	Table of times of elongations and azimuths of Polaris between the years 1890 and 1910.
12	A. M. Ford, Salem, N. J	Explanations of Tide Tables published by Coast and Geodetic Survey.
12	D. A. Compton, Hawley, Pa	Information as to the velocity of the tide wave in the Hudson and Delaware rivers.
15	Osceola Phosphate Company, Albion, Fla	Elevation of the Albion bench mark above mean sea level.
16	J. M. Searles, Vicksburg, Miss	Magnetic declination and annual change for 1890 at Vicksburg, Miss.
16	R. M. Rich, Beverly, Mass	Magnetic declination and annual change for 1890 at Bucksport, Me.
17	W. R. Hillyer, Port Richmond, N. Y	Magnetic declination at Port Richmond in 1824.
20	J. L. Bryan, Cambridge, Md	Magnetic declination at Cambridge, Md., in 1894, and annual increase.
20	W. S. Rich, Cambridge, Mass	Information concerning the size and figure of the earth; Coast and Geodetic Survey Report for 1880 and 1892.
21	G. A. Sanders, Laconia, N. H	Air line distance from Laconia to Wentworth and from Wentworth to Littleton.
22	L. C. Baker, United States Marine-Hospital Service, Washington, D. C.	Position of the geographical center of the United States.
23	W. H. Temme, Canal, Ind	Appendices on terrestrial magnetism; secular change of the declination in Warrick County, Ind.
26	Maj. D. P. Heap, U. S. E., Portland, Me	Descriptions of three bench marks in various parts of Maine.
26	J. Marden, secretary Board of Tide Land Appraisers, Tacoma, Wash.	Geographical positions and descriptions of 21 trigonometric stations in the vicinity of Steilacoom and Commencement Bay, Puget Sound.
30	U. S. Geological Survey, Washington, D. C	Geographical position of station "Plateau," Colorado.
	—— Hunt, engineer of bridges, Washington, D. C	Height of bench mark 46 in District of Columbia.
7	W. F. King, International Boundary Commissioner, Ottowa, Canada.	Tracings of original topographical sheets of Taku Inlet, Bradfield, Portland, and Behm canals, Earnest Sound, Frederick Sound, and Stephens Passage.
8	Olmstead & Elliot, Brookline, Mass	Tracing of original sheet of Lynn Harbor, Mass.
17	Henry W. Brower, C. E., Georgetown, D. C	Copy of survey of U. S. Naval Observatory grounds.
19	Maj. W. S. Stanton, U. S. E., Wilmington, N. C	Tracing of upper part of Alligator River, North Carolina, from original hydrographic sheets Nos. 218 and 1315.
21	Lt. Col. Peter C. Hains, U. S. E., Portland, Me	Tracing of hydrography of Cape Porpoise Harbor from original sheet.
24	Lt. Col. H. M. Robert, U. S. E., New York	Copy of topographical survey from Far Rockaway to Great Bar Hassock, Long Island, N. Y., from original sheet No. 1471*a*.
Dec. 1	H. L. Fairchild, Rochester, N. Y	Elevation above mean sea level of bench mark at Albany, N. Y.
1	L. C. Heywood, Pawtucket, R. I	Geographical positions and descriptions of seven trigonometric points in the vicinity of Pawtucket; results of latest adjustment of the triangulation; two appendices.
	Assistant district attorney, Washington, D. C	Information concerning tides in the Potomac River.
12	H. P. Simpson, Hydrographic Office, Navy Department, Washington, D. C.	Geographical positions and descriptions of stations "Friars Head" and "Crane Neck," New York.
13	W. & L. E. Gurley, Troy, N. Y	Two copies of Bulletin No. 14; Appendices Nos. 11 of 1889 and 6 of 1885; 2 isogonic maps for 1885.
13	L. C. Heywood, Pawtucket, R. I	Information in regard to the computation of geographical positions.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1894.		
Dec. 17	U. S. Geological Survey, Washington, D. C.	Geographical positions, descriptions, and elevations of 4 trigonometric stations in Tennessee.
5	Lieut. C. E. Gillette, U. S. E., San Francisco, Cal	Copy of hydrographic survey of Suisun Bay, California, from original sheets.
5	Capt. W. H. Bixby, U. S. E., Newport, R. I	Copy of hydrographic survey of Stonington Harbor, from original sheet No. 1577*a*.
5	W. F. King, International Boundary Commissioner, Ottawa, Canada.	Geodetic positions of points in the vicinity of Chickamin River and Portland Canal, Alaska.
13	Bureau of Education, Washington, D. C.	Map of Alaska prepared for photolithography, to show reindeer stations.
13	Capt. H. C. Taylor, U. S. N., Naval War College, Newport, R. I.	Tracings from original hydrographic sheets Nos. 1844–1879, and 1947—Nantucket Sound.
1895.		
Jan. 2	O. A. Veazey, Dego, W. Va	Latitude, longitude, azimuth, and elevation of trigonometric stations Table Rock, Holmes, and Summersville.
2	S. M. Holdridge, San Francisco, Cal	Geographical position (approximate) of Ukiah C. H., Cal.
2	U. S. Geological Survey, Washington, D. C.	Geographical position of Pikes Peak, Colo.
3	H. von Bayer, U. S. Fish Commission, Washington, D. C.	Three appendices treating of magnetic declination; copy of Bulletin No. 14.
3	E. D. Hardesty, Harlowe, N. C.	Table of magnetic declinations for Beaufort and Newbern, between the years 1770 and 1900; three appendices treating of magnetism.
8	H. L. Dillworth, Centerville, Del	Table showing changes in the magnetic declination in the vicinity of Wilmington, Del., during the past 50 years.
9	U. S. Geological Survey, Washington, D. C.	Geographical positions of 3 trigonometric stations in Georgia.
11	C. S. Woodard, Ypsilanti, Mich	Table of changes of magnetic declination at Ypsilanti, Mich.; results of discussion of magnetic observations at Los Angeles, Cal.
15	Theodore Moreno, Gainesville, Ga	Magnetic declination at Gainesville for 1895; Appendix No. 12 of report for 1886 and Bulletin No. 14.
16	H. J. Hayes & Son, Winslow, Ark	Elevation of bench marks at Winslow railroad station and Summit Hotel, above the mean level of the Gulf of Mexico.
17	Shedd & Sarle, civil engineers, Providence, R. I.	Geographical positions and descriptions of 2 trigonometric points, and data for geodetic computation.
18	U. S. N. Hydrographic Office, Washington, D. C	Two isogonic charts showing the curves for 1895 in the NE. Pacific, Bering Sea, and northern Alaska.
18	Richard B. Wall, Waterford, Conn	Description of station "Manetuck" and copy of Appendix No. 8 of report for 1888.
18	H. D. Jefferson, Franklin, Tenn	Three appendices on magnetic declination and Bulletin No. 14.
18	U. S. Geological Survey, Washington, D. C	Geographical positions of 4 trigonometric stations in the vicinity of the Kansas and Colorado boundary line.
19	H. D. Whitcomb, U. S. E., Richmond, Va	Elevation of bench mark at Old Point light-house above mean sea level.
22	J. D. Davis, Reeds, Mo	Elevation of bench mark at Reeds, Mo., above mean level of the Gulf of Mexico.
23	Lieut. Commander C. H. Arnold, U. S. N., branch hydrographic office, New York.	Hourly readings of the Fort Hamilton tide gauge for August 19 and 20, 1893.
25	Capt. F. V. Abbot, U. S. E., Charleston, S. C	Descriptions of two bench marks at St. Simons Sound.
25	Sawyer-Man Electric Company, New York	Magnetic dip and horizontal force in the United States for 1885, and declination for 1890.
26	F. G. Plummer, C. E., Tacoma, Wash	Magnetic declination for Tacoma and annual change for the State of Washington.
26	R. H. Rich, Beverly, Mass	Table of elongations and azimuths of Polaris; geographical position of Beverly, Mass.
28	James M. Gibboney, Wytheville, Va	Table of secular variation of the magnetic declination between the years 1795 and 1900; time of zero declination and present value.
29	J. H. Leippe, Reading, Pa	Latitude and longitude of trigonometric station "Black Spot."
29	Prof. Thomas Grey, Rose Polytechnic Institute, Terre Haute, Ind.	Results of the pendulum research of the Coast and Geodetic Survey during the year 1894.
31	H. T. Douglas, chief engineer of the Baltimore Topographical Survey.	Explanatory remarks concerning the relation of the work of the Coast and Geodetic Survey and that of the city of Baltimore, with resulting lengths of certain trigonometric lines.
8	Board of Park Commissioners, Cambridge, Mass	Sheet of Boston Harbor with results of latest hydrographic survey.
9	C. B. Northrop, Charleston, S. C	Tracing of topography in the vicinity of St. Augustine, Fla., from original topographic sheet.
14	Bureau of Education, Washington, D C.	Sketch map of Alaska, prepared for photolithographing, showing proposed reindeer mail routes.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Jan. 19	Virginia State Oyster Survey	Four projections on scale of $\frac{1}{20000}$, outer coast of Virginia, with shore-line and trigonometric positions.
Feb. 2	W. B. Getchell, C. E., Augusta, Me	Descriptions of bench marks at Augusta and Hallowell, Me.
2	J. P. Bogart, C. E., New Haven, Conn	Information concerning geographical positions in the vicinity of New Haven, Conn.
4	J. P. Bryant, C. E., New Haven, Conn	Azimuths and times of elongation of Polaris.
4	E. F. Smith, Madera, Cal	Information concerning magnetic declination.
4	U. S. Geological Survey, Washington, D. C	Geodetic data for 2 trigonometric points in eastern Colorado.
5	F. G. Cudworth, Fort Ethan Allen, Vermont	Elevation of Lake Champlain; Appendix No. 7 of report for 1887.
6	O. H. Tripp, C. E., Rockland, Me	Geographical positions of 6 primary and 12 subordinate trigonometric points in the vicinity of Rockland, Me.
8	Capt. S. S. Smith, U. S. E	Height of bench mark at Fort Montgomery, Lake Champlain.
9	W. W. Blakeley, C. E., Philadelphia, Pa	Horizontal angles measured at Governor Dick and Swatara stations; latitude, longitude, and azimuth of the same stations.
9	Chas. A. Ferry, New Haven, Conn	Expression for the magnetic declination at New Haven; copy of Bulletin No. 14.
9	W. W. Hodges, Chicago, Ill	Starting level of the line of levels from New York to St. Louis, and reference to the survey of the lakes by the U. S. Engineers.
12	Prof. L. M. Haupt, University of Pennsylvania, Philadelphia, Pa.	Descriptions of two bench marks at Aransas Pass, Tex.
13	Frank M. Duffy, Guthrie, Ky	Magnetic declination at Guthrie, Ky., and various publications relating to magnetism.
14	O. H. Tripp, C. E., Rockland, Me	Descriptions of 3 trigonometric stations near Rockland, Me.
16	E. T. Cox, Albion, Fla	Elevations of various bench marks on the line across the peninsula of Florida from St. Augustine to Cedar Keys.
16	Z. B. Newton, Hope Mills, N. C	Information concerning the position of the north magnetic pole, and collections of magnetic observations; various appendices on the subject of terrestrial magnetism.
16	Prof. L. M. Haupt, Philadelphia, Pa	Description of bench mark at Ropesville, Aransas Pass, Tex.
16	Convers & Kirlin, New York	Tides at Delaware Breakwater for November 23 and 24, 1894.
18	J. F. Schmeltzer, Manteno, Ill	Appendices Nos. 7 of 1888 and 11 of 1889 and Bulletin No. 14.
23	Prof. M. Merriman, Lehigh College, Pennsylvania	Additions to the table for the times of culmination and elongation of Polaris during the period 1895 to 1905.
25	Prof. Geo. H. Hamlin, Orona, Me	Descriptions of bench marks at Bangor, Me.
26	Rev. J. J. Abell, Bethlehem Academy, St. John, Ky	Geographical positions of 4 trigonometric stations in the vicinity of Louisville, Ky.
26	J. W. Brower, St. Paul, Minn	Latitude and longitude of Lima, Beaverhead County, Mont.
28	F. W. Starbuck, Racine, Wis	Elevations above sea level of Santa Rosa, San Luis Obispo, and San Jose, Cal.
7	E. R. Sharwood, secretary Philadelphia Maritime Exchange.	Tracing of hydrographic survey of the vicinity of the Delaware Breakwater.
12	H. C. Ripley, Galveston, Tex	Tracing of the shore line of Galveston Bay from the mouth of Dickinsons Bayou to Highland Bay, from original topographical sheets.
27	Theodore C. White, School of Mines, Columbia College, New York.	Blue print from tracing of the topography of Great and Little Cranberry islands, Me., from original sheets.
Mar. 1	W. S. Taylor, State University of Louisiana	Latitude and longitude of the astronomical station at Baton Rouge, La.; elevation of two bench marks above the mean level of the Gulf of Mexico.
5	F. M. Duffey, Guthrie, Ky	Magnetic declination at Guthrie, Ky., in 1895; copies of appendices Nos. 7 of 1888 and 11 of 1889.
6	C. B. Twing, University of Wisconsin	Suggestions for tabular statements of magnetic constants for the United States; eight appendices on the subject of terrestrial magnetism.
8	W. McC. Brown, Bayard, W. Va	Time of eastern elongation and azimuth of Polaris for March 3, 1895.
8	Rear-Admiral W. J. L. Wharton, R. N., London, England.	High and low waters at Sausalito, Cal., for the year 1894, and harmonic constants for the same station for the year 1889.
11	J. A. Ockerson, St. Louis, Mo	Geographical position and description of the station at La Crosse, Wis.
12	Alfred Meads, Ontonagon, Mich	Appendices Nos. 6 of 1885, 7 of 1888, and 11 of 1889.
12	J. W. Lockhart, Bluff City, Tenn	Elevation of Bristol, Tenn.; magnetic declination of Bristol, Tenn.
12	J. Stanley Brown, Washington, D. C	Distances and azimuths between Washington Old Observatory, University of Virginia, Lynchburg, Va., and Statesville, N. C.
12	G. M. Donham, Portland, Me	Advance copies of tide predictions for Eastport and Portland, Me., for the first four months of 1896.
19	C. J. Brown, engineer of St. Louis and San Francisco R. R.	Elevations of bench marks on the line between Carthage, Mo., and Chester, Ark.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Mar. 19	M. Harrington, Chief of Weather Bureau, Washington, D. C.	Elevation of bench marks on the line from St. Louis, Mo., to Kansas City, Mo.
20	W. B. Dawson, department of marine and fisheries, Ottawa, Canada.	High and low waters at Fort Hamilton, N. Y., for December, 1894, and January, 1895.
22	B. H. Wright, Penn Yan, N. Y.	Table of the semimensual phase inequality in time and height, for Savannah, Ga.
25	O. J. Klotz, Canadian boundary commission	Geographical positions of 7 astronomical stations of the Coast and Geodetic Survey.
26	J. C. Nagle	Appendices Nos. 6 of 1885, 12 of 1886, 7 of 1888, and 11 of 1889.
20	J. W. Kendrick, St. Paul, Minn.	Tracing of hydrography of part of Tacoma Harbor, Washington, from original sheet of 1895 survey.
Apr. 1	J. V. Davies, chief engineer N. Y. & L. I. Bridge Company, New York.	Descriptions of five bench marks in the vicinity of New York.
5	C. S. Weber & Co., New York	Distance between New York City and Hartford, Conn.
8	J. A. Holmes, State geologist of North Carolina	Table of secular magnetic variation 1760 to 1895, 5; appendices Nos. 7 of 1888, and 12 of 1886.
8	Maj. D. P. Heap, U. S. E., Portland, Me	Descriptions of five bench marks on the Kennebec River, Me.
8	W. Bell Dawson, department of marine and fisheries, Ottawa, Canada.	Explanation of variations in the tidal difference between two stations.
9	J. P. Perkins, Sacaton, Ariz	Information as to the present annual change of magnetic declination in Arizona; appendices Nos. 7 of 1888 and 11 of 1889.
15	U. S. Geological Survey, Washington, D. C.	Geographical positions of 3 trigonometric stations in West Virginia.
16	O. J. Klotz, Ottawa, Canada	Geographical position of Mount Fairweather, Alaska, with azimuths and elevation.
19	U. S. General Land Office, Washington, D. C.	Geographical positions and descriptions of stations on the south side of the Columbia River, along the coast to Tillamook Bay, and in the vicinity of Port Orford and Coos Bay, Oregon.
16	Henry Meier, Baltimore, Md.	Predicted times of high water for Baltimore, Md., for the year 1896; list of establishments for 48 places on the Upper Chesapeake.
18	W. E. Belknap, C. E., Brooklyn, N. Y.	Information as to the highest tide recorded at Sandy Hook, New Jersey.
20	U. S. Geological Survey, Washington, D. C.	Geographical position and description of trigonometric station "Clinch," Tennessee.
22	J. S. Peter, Corpus Christi, Tex.	Geographical positions and descriptions of 8 trigonometric stations in the vicinity of Baffin Bay and Laguna Madre, Texas.
22	Col. Anson Mills, U. S. A.	Descriptions of reconnaissance stations along the Rio Grande from El Paso to the Gulf of Mexico.
22	Capt. G. A. Zinn, U.S.E., Mississippi River Commission.	Geographical positions and descriptions of stations along the Mississippi River from Minneapolis southward.
22	Adolfo Faidigo, astronomical and meteorological observatory, Trieste, Austria.	Description of the tide-predicting machine in use by the Coast and Geodetic Survey.
22	Cambridgeport Diary Company, Cambridgeport, Mass.	Tidal predictions for San Francisco, Cal.; San Diego, Cal.; Astoria, Oreg.; Port Townsend, Wash., and Sitka, Alaska, for the year 1896.
24	W. P. Hardesty, Salt Lake City, Utah	Appendices treating of terrestrial magnetism.
25	U. S. Geological Survey, Washington, D. C.	Geographical positions of 230 trigonometric stations along the coast of Oregon.
27	W. B. Cochrane, Stamford, Conn.	Identification of a number of trigonometric positions in the vicinity of Stamford, Conn.
29	H. N. Shultz, Foxville, Md.	Information concerning local deviations of the magnetic needle; Appendices Nos. 6 of 1885 and 11 of 1889.
May 2	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of three trigonometric stations in the vicinity of Nashville, Tenn.
3	J. A. Bullock	Information as to methods of determining the true bearing of the Virginia and North Carolina boundary.
3	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 3 trigonometric stations near the southern boundary of New Hampshire.
3	Capt. T. A. Bingham, U. S. E.	Geographical positions and descriptions of 17 trigonometric points in the vicinity of Chattanooga, Tenn.
3	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 2 trigonometric stations in southern New Hampshire.
6	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 3 primary trigonometric stations in Colorado.
6	T. W. G. Davidson, C. E., New York	Appendix No. 7 of report for 1888.
7	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 2 trigonometric stations in New York and Vermont.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
May 7	C. S. Kemper, Acting Supervising Architect, Treasury Department, Washington, D. C.	Tracing of hydrography in the vicinity of Reedy Island, Delaware River, from original sheet.
8	L. Wilson, Haverstraw, N. Y.	Geographical position and description of a trigonometric station on the Hudson River.
9	E. J. Houston, Philadelphia, Pa	Information concerning terrestrial magnetism, and 10 appendices on the subject.
10	W. B. Cochrane, C. E., Stamford, Conn	Descriptions of 4 trigonometric stations in the vicinity of Stamford, Conn.
10	Kiggins and Tooker Company, New York	Predicted times of high water at San Francisco, San Diego, Astoria, and Port Townsend for the year 1896.
15	W. H. Holmes, Philadelphia, Pa	Geographical position and elevation of Mount St. Elias, Alaska, and reference of the same to the international boundary.
18	E. Mitchell, C. E., Manchester, Va	Elevations and descriptions of 3 bench marks at Richmond, Va.
20	U. S. Geological Survey, Washington, D. C	Geographical positions of 7 trigonometric stations in Alabama.
22	C. A. Gonzales, Mexico, Mexico	Appendices Nos. 7 of 1888 and 6 of 1885.
22	Professor Keith, Philadelphia Public Ledger, Philadelphia, Pa.	Predicted times and heights of high and low water at Philadelphia for the year 1896.
23	W. H. Holmes, Philadelphia, Pa	Elevations of the 3 highest mountains in Alaska.
23	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of 67 trigonometric stations in California.
23	E. E. Rose, Philadelphia, Pa	Magnetic declination at Philadelphia, its annual change and diurnal variation; Appendices Nos. 7 of 1888, and 11 of 1889.
24	O. Klotz, topographical survey, department of the interior, Ottawa, Canada.	Geographical positions and elevations of Mount Fairweather and Mount La Perouse.
24	H. C. Lord, Ohio State University, Columbus, Ohio	Latitude and longitude of the State House at Columbus, Ohio.
24	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of 7 trigonometric stations in Alabama.
27	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of 32 trigonometric stations in California.
28	J. S. Peter, C. E., Corpus Christi, Tex	Geographical positions and descriptions of 5 trigonometric stations near Baffin Bay, Texas.
28	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of 17 trigonometric stations in Chesapeake Bay.
31	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of 70 trigonometric stations in the State of Washington.
June 1	Nautical Almanac Office, Washington, D. C	Predicted tides for San Francisco, San Diego, Astoria, Port Townsend, Sitka, St. Paul, Honolulu, and Panama, for the year 1896.
5	W. Bryant, Salt Lake City, Utah	Various expressions for the intensity of gravity, with reference to results, particularly for places in the United States.
6	Lieut. E. A. Anderson, U. S. N., Cleveland, Ohio	Latitude and longitude of the Marine Hospital at Cleveland, Ohio, and magnetic declination at the same place.
10	S. Dean, surveyor, Glenwood, Iowa	Appendices Nos. 6 of 1885, 7 of 1888, and 11 of 1889.
12	United States Geological Survey, Washington, D. C.	Geographical position and description of the astronomical station at Trinidad, Colo.
13	H. Van Duzee, Philadelphia, Pa	Geographical positions and descriptions of three trigonometric stations in the vicinity of Glenholden Borough, Pa., with azimuths and distances.
18	M. Taylor, surveyor, Hill Station, Va	Appendix No. 7 of report for 1888.
18	W. D. Chesterman, Richmond, Va	Heights of Mitchells High Peak, Blackstock Knob, Richland Balsam Mountain, and Mount Washington.
18	U. S. Navy Department, Washington, D. C	Tracing of original sheet of the special survey of Puget Sound Naval Station, Port Orchard, Washington.
19	Prof. J. E. Denton, Stevens Institute of Technology, Hoboken, N. J.	Information concerning currents in Long Island Sound.
22	Louisiana State Survey	Proof of unfinished chart No. 197, Barataria Bay to Terrebonne Bay, Louisiana.
24	G. S. Ely, Washington, D. C	Magnetic declination at Dunkirk, N. Y., from 1790 to 1900.
26	H. C. Lord, Columbus, Ohio	Relative weights of modern star catalogues.
26	H. M. Chittenden, U. S. Engineers Office, Columbus, Ohio.	Latitude, longitude, and magnetic declination of the Yellowstone Park station determined by the Coast and Geodetic Survey in 1892.
28	N. Spofford, surveyor	Information concerning the position of station "Warwick," on the Massachusetts and New Hampshire boundary line.
28	T. M. Draney	Distance from Washington, D. C., to Norfolk, Va.
28	S. J. Flavell, Sea Cliff, Long Island, N. Y	Tidal differences for Governors Island and Sea Cliff, N. Y.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
June 28	Frederick D. Fisk, Boston, Mass	Descriptions of bench marks at Charlestown Navy-Yard, and estimate of cost of replatting certain hydrography in Charles River.
28	J. W. Merritt, Brooklyn, N. Y. (for the Brooklyn Eagle Almanac).	Predicted times and heights of high and low water at New London, New York, and Sandy Hook, for the year 1896; explanation of manner of using tidal differences and ratios.
28	U. S. Navy Department, Washington, D. C.	Tracing of survey of the Hudson River from Eightieth street, New York, to Yonkers, from original sheets.
28	Britton & Gray, San Francisco, Cal.	Tracings of hydrography of Tacoma Harbor from the surveys of 1877 and 1895. Scale, $\frac{1}{2500}$.

OFFICE REPORT NO. 1—1895.

REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY OFFICE,
Washington, D. C., June 30, 1895.

SIR: I have the honor to submit the annual report of the Office for the fiscal year ending June 30, 1895, accompanied by the annual reports of the various divisions thereof as follows:

1. The computing division, by Assistant C. A. Schott, chief.
2. The tidal division, by Mr. L. P. Shidy, acting chief.
3. The drawing division, by Assistant Will Ward Duffield, chief.
4. The engraving division, by Assistant Will Ward Duffield, chief.
5. The chart division, by Assistant Gershom Bradford, chief.
6. The miscellaneous division, by Mr. W. P. Ramsey, chief.
7. The instrument division, by Assistant J. Pratt, chief.
8. The library and archives division, by Mr. H. S. King, chief.

Assistant B. A. Colonna served as Assistant in Charge of the Office from the beginning of the fiscal year until March 11, 1895, when he tendered his resignation to take effect April 10, leave of absence for the intervening time being granted him. By your instructions of March 11, I was detailed to act as Assistant in Charge of the Office during this interim, and on its expiration was duly appointed to the position by the Honorable Secretary of the Treasury and was also directed to act as Superintendent during your absence.

The computing division has continued under the supervision of Assistant C. A. Schott, and the usual amount of work has been accomplished. The force of this division is too small for the great demands made upon it, but it has been reinforced from time to time by the temporary detail of assistants when not actively engaged in the field. The following-named members of the field force have thus been detailed for short periods: Assistants A. T. Mosman, H. G. Ogden, F. D. Granger, Isaac Winston, and John Nelson. Subassistants F. A. Young, and Aids A. L. Baldwin, O. B. French, S. B. Tinsley, and H. C. Denson. Mr. L. G. Schultz, expert observer, was also similarly detailed after the close of the work at the San Antonio Magnetic Observatory. An account of the special duty performed by each of these officers will be found in the report of Assistant C. A. Schott.

The tidal division during the whole year was under the immediate direction of Mr. L. P. Shidy, as acting chief, and his report contains a full account of the work performed during that time. The large amount of extra labor involved in the change of form of the annual Tide Tables, the addition of a large number of foreign ports, and the fact that considerable time was necessarily spent in discussing the proposed changes, rendered a considerable reenforcement of the division necessary, and the following-named field officers were at various times detailed to assist in the computations and compilations: Assistants F. W. Perkins, E. D. Preston, W. I. Vinal, Stehman Forney, G. R. Putnam, Subassistant F. A. Young, and Aid C. C. Yates. Notwithstanding this assistance the issue of the Tide Tables for 1896 was delayed several months beyond the proper time, and the regular force of the division voluntarily worked overtime in order to expedite the publication. The usual amount of work in supplying field parties with necessary data, and outside parties with desired information, was accomplished, and plans for a new tide-predicting machine,

embodying the best features of the Thomson and Ferrel machines, have, with the cooperation of the instrument division, been prepared, and approved by the instrument board. The construction of the machine is now in progress.

The drawing division continued under the charge of Assistant W. H. Dennis until May 8, 1895, when his connection with the Survey ceased, and Assistant A. T. Mosman took temporary charge pending the appointment of a new chief. Assistant Will Ward Duffield was designated as chief of the division on June 16, and at once entered upon his duties. His report for the fiscal year contains a full exhibit of the work accomplished, and is accompanied by a tabular statement of information furnished to, and work done for, other departments of the Government, and for private individuals in reply to special requests.

The engraving division, from the beginning of the year to June 26, 1895, was under the immediate direction of Assistant George A. Fairfield, as acting chief, the regular chief, Assistant H. G. Ogden, having been assigned to special field duty. Mr. Ogden resumed duty as chief of the division for the remaining few days of the year and was succeeded on July 1 by Assistant Will Ward Duffield, the consolidation of the drawing and engraving divisions being effected at that date. The annual report of the division is submitted by Assistant Duffield, and contains a very full and complete account of the various classes of work executed, and is accompanied by tabular statistics relating to the engraving, photolithographing, electrotyping, chart printing, and photographing operations. The reduction of the force of engravers by the resignation of Mr. A. Petersen, the long-continued sickness of Mr. E. J. Enthoffer, the death of Mr. Gilbert F. Dawson, and the suspension of the three "extra engravers" seriously hampered the engraving work of the division for a time. In this connection I desire to recommend strongly the abolition of the system of "contract engraving," which has been in vogue for a number of years, and that in future all such work be done in the Office by regularly employed engravers. This will necessitate a slight increase in the regular force of the division, but will not cost the Government anything additional, as the sums now appropriated for the contract work will suffice to pay the new employees. The advantages of this change are obvious, as the work will be then under the constant supervision of the Office, no risk of loss of plates or damage in transportation will exist, and the Government will be saved the cost of advertising for bidders. Under the present system advertising is necessary for each plate or set of plates to be engraved by contract, and the cost during the year is quite considerable.

The chart division has continued during the whole year under the charge of Assistant Gershom Bradford, and the usual amount of work in correcting charts and bringing aids to navigation up to date of issue has been accomplished. Assistant Bradford's report shows in concise tabular form the number of engraved and pholithographed charts received and issued during the year, and a comparison of the issue with that of the six previous years.

The miscellaneous division continued under the direction of Mr. M. W. Wines until August 31, 1894, when he was succeeded by Mr. W. P. Ramsey, who has satisfactorily performed the duties of chief of the division. His annual report gives all the necessary information in regard to the chart agencies of the Survey and the distribution of the various official publications.

The instrument division continued under the charge of Assistant Edward Smith until January 17, when, at his own request, he was relieved and assigned to field duty. He was succeeded by Assistant J. F. Pratt, who has efficiently conducted the business of the division and who submits its annual report.

The library and archives division since August 21, 1894, has been under the charge of Mr. H. Sidney King, the resignation of the former chief, Mr. F. H. Parsons, having taken effect on that date. In his report, Mr. King makes valuable suggestions as to the better arrangement and cataloguing of the books of the library and these are now being carried out. His report also contains the usual statistics showing the number of volumes, maps, and charts purchased, presented, or obtained by exchange during the year, and the number of volumes of original and duplicate records of field work of all kinds, and the number of original topographic and hydrographic sheets deposited and registered in the archives.

The changes in the personnel of the Office due to deaths, resignations, and dismissals have been unusually numerous, but being given in detail in the reports of the various chiefs of divisions, need not be enumerated here. In my immediate office no changes occurred in the clerical force,

Mr. A. B. Simons continuing to serve as clerk to the Assistant in charge and Mr. E. B. Wills in charge of the leave of absence accounts and of the freight, express, and registered mail matters. Miss Kate Lawn and Miss Sophie Hein attended to the typewriting and copying for the Office and also performed miscellaneous clerical work. All have attended to their duties in a satisfactory manner. Miss Ida M. Peck, early in the fiscal year was assigned to duty in the office of the disbursing agent and rendered valuable service there throughout the year. For one month, however, she was detailed to the Treasury Department for special duty.

Mrs. Mary L. Godwin, who was appointed as chart corrector on April 26, was detailed to the Treasury Department on May 1, and continued on duty there until the close of the year, when she was permanently transferred to that Department.

Mr. N. G. Henry, clerk and cashier, and Mrs. Jennie H. Fitch, clerk, have satisfactorily performed their respective duties in the office of the disbursing agent, and Mr. William B. Chilton has continued to serve in the Superintendent's Office.

In addition to the regular duties of the office, the Assistant in charge has presided over the meetings of the various advisory boards, and acted as Superintendent during your absences.

Yours, respectfully,

ANDREW BRAID,
Assistant in Charge of Office.

Mr. W. W. DUFFIELD,
Superintendent U. S. Coast and Geodetic Survey.

REPORT OF THE COMPUTING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

COMPUTING DIVISION, *June 30, 1895.*

SIR: In conformity with the regulations of the Survey, I have the honor to submit herewith the annual report of the work accomplished in the computing division of the Office during the year ending June 30, 1895.

The charge of this division has remained with me, and the personnel of the computing force is the same in number as in the preceding year; the position vacated by the resignation of Mr. Henry Farquhar resulted in the promotion of Mr. H. F. Flynn, and in the probationary employment of Mr. J. Pawling as computer. By the resignation of Mr. Farquhar, on February 8, 1895, after fifteen years of service, the Survey lost an experienced computer, and one who had especially distinguished himself in the assignment of excellent mean places of stars for the latitude work. Mr. J. Pawling reported for duty March 29, 1895. During the winter season temporary assistance was given this division by the attachment of a number of members of the field force, with the advantage to the Survey of keeping them steadily employed, and affording them the means of becoming more familiar with the methods of computation. Their names, and the dates when they served temporarily in this division, will be given further on, in connection with the statement of the special work engaged upon.

The duties devolved upon me as chief of the computing division include the direction of the work of each computer, distributing the same according to his special qualifications, and timing it so as to secure the best cooperation. They include the reporting of the results reached and their critical value; the preparation of information demanded for field and office use, and in the general correspondence of the Office and related to this division, and the preparation of replies to questions asked and referred to it. After discharging these and other duties of smaller import, time was found to revise computations and prepare for publication the resulting lengths of the Holton and the St. Albans base lines; to collect and discuss observations of magnetic declination in Alaska and adjacent regions, showing annual change and distribution by an isogonic chart for the year 1895; to discuss the changes of the magnetic force (in direction and intensity) at San Francisco; to compute the magnetic observations made at Port Townsend and at Olympia, Wash.; to keep

up to date the magnetic discussions demanded to supply the charts with the compass variations; to compute the longitude of Camp Colonna, on the Porcupine River, Alaska (boundary survey), from observations of moon culminations and one occultation; to take part in proof reading for report, and in the preparation of the annual and the special statistics of astronomic work of the Survey (longitudes, latitudes, and azimuths) during the years 1888 and 1895, for publications by the International Geodetic Association. The transit of Mercury of November 10, 1894, was observed by me, and the result, together with those of other observers, was submitted for use at the United States Naval Observatory.

Among a series of reports I may mention one on the results of spirit leveling across the peninsula of Florida, one on the geodetic results in the Mount St. Elias region, Alaska, and one on the results of the astronomic work by the late Assistant Turner in Alaska during 1889 and 1890.

A study was made of the present state of the general telegraphic longitude net of the United States, with a view of supplying a few links for its speedy completion.

A condensed specification of the work done during the fiscal year by each computer is herewith presented. It is made up from the daily and monthly reports, as submitted.

Edward H. Courtenay was engaged in the computations and adjustments of the following triangulations: Vicinity of Lake Tahoe, California and Nevada, 1893; coast triangulation from Mendocino Bay to Shelter Cove, California, 1872–1874, fitting it in with the main triangulation of later date; vicinity of Unuk and Taku inlets, Alaska, 1893; coast of Louisiana between Vermilion Bay and Sabine Pass, 1882–1889; vicinity of Camp Colonna, on the Porcupine River, 1890, and of St. Michael, Alaska, 1891. He also directed the adjustment of the additional triangulation on the south side of Long Island, New York, 1888; advanced the office computation of the triangulations of Chilkoot and Chilkat inlets, Alaska, 1894; computed a number of base lines; attended to various geodetic computations, and assisted in the preparation of the geodetic statistics, arranged records and computations for the binder, and in general supervised the work of Mr. J. B. Boutelle, of Mr. Kummell, and directed the work of the copyist. I have also to acknowledge his assistance in the collection and preparation of such geodetic data or information as were required or specially called for.

Myrick H. Doolittle attended to the reduction of the primary triangulation in Utah east of the Wasatch Range, carrying the adjustment of the line Mount Ellen to Patmos Head; computed and adjusted the main triangulation in western Kansas, of 1893; prepared abstracts of horizontal measures at stations surrounding the old base line in El Paso County, Colo., and assisted in the preparation of geodetic statistics. During part of April and during May Mr. Doolittle's health failed him. Since his resumption of work he has computed the secondary triangulations about Ibepah and Pilot Peak, Utah, 1889, for which data had been received but recently.

Henry Farquhar computed the places of stars, and the latitudes of the following stations: El Paso, Tex., 1892; Mount Conness, California, 1890; Mount Ellen, Utah, 1891; Anchorage Point, Chilkat Inlet, Alaska, 1894; and nearly completed the latitude computation of station Mount Waas, Utah, 1893. He also prepared a list of mean places of stars for the latitude work at San Francisco of 1894.

Charles H. Kummell was chiefly engaged in the solution of equations required in the adjustments of angles, of triangulations, or in magnetic work; in revising and checking computations and tabulations of results. He assisted in the preparation of abstracts of horizontal angles on the Stikine River triangulation, 1893; computed geographical positions of the coast triangulation of California, and between Pensacola and Perdido Bay, Alabama, and computed apparent places of stars for latitude work.

John B. Boutelle was principally engaged in attending to the geographical registers kept in the computing and drawing divisions; in preparing and revising abstracts of angles, and in preparing copies of results for use in the field or in response to applications, and in copying reports for transmission; also in attending to the selection of records of description of stations, and their copying by the clerk for immediate use. Mr. Boutelle completed the computations of the triangulations of Suisun Bay, California, 1886–1888; of Mobile Bay entrance, Alabama, 1892, and of the south side of Long Island, New York, 1888. He was on field duty between September 6 and October 7, 1894, and again from May 29 to the close of the fiscal year.

Daniel L. Hazard computed the following telegraphic differences of longitude: San Francisco and Oakland, 1889; Helena and Salt Lake City, 1890; Helena and Bismarck, 1890; Bismarck and Minneapolis, 1890; Cape May and Albany, 1891; Albany and Detroit, 1891; Detroit and Chicago, 1891; Chicago and Minneapolis, 1891; Minneapolis and Omaha, 1891; San Diego and Los Angeles, 1892, and Tacoma and Seattle, 1894, with three secondary stations in Ohio and Indiana; also the chronometric longitude Sitka to Chilkat, 1894, and the longitude of Fort Yukon and of the old Rampart House on the Porcupine River, Alaska, 1891. Mr. Hazard reduced the transit observations at San Francisco, Cal., 1890–91; at Camp Colonna, eastern boundary of northern Alaska, 1890–91, and at St. Michael, Alaska, 1890–91; deduced the longitude of the last two places from moon culminations and occultations; computed the astronomic azimuths at Bear, Ala., 1889; at Chilkat, Alaska, 1894; at Lituya Bay, Alaska, 1894, and at St. Michael, Alaska, 1890–91. He also computed the magnetic observations made in Alaska in 1893; in California in 1890–1893; in Southern and Western States by Assistant Baylor in 1891–1893; in Utah in 1891–1893, and at Carson and Lake Tahoe, Nevada, 1894. Much credit is due to this computer for the great output of work and its excellent character.

Harry F. Flynn assisted in the computations for geographical positions in the triangulations of vicinity of Lake Tahoe, California and Nevada; of Mendocino City to Shelter Cove, California; of entrance to Stikine River, Alaska; of Unuk and Taku rivers, Alaska, and of Pensacola and Perdido bays, Florida and Alabama; reduced the base line at Baltimore, 1894, and computed the area of certain parts of ground about the new United States Naval Observatory. He also computed mean places of stars, and made some magnetic computations; computed the latitudes of Camp Colonna, on the Porcupine River, 1890; of St. Michael, 1891, and of Camp Davidson, Yukon River, 1889; also made computations of some miscellaneous astronomic work at Fort Yukon and the Porcupine River of 1890–91.

Lilian Pike was engaged principally upon the computation, inclusive of adjustment, of the triangulation of Stikine River from observations by Assistants O. H. Tittmann, J. E. McGrath, and H. G. Ogden, 1893. She also took part in the position computations of the triangulations about Lake Tahoe; on the California coast above Mendocino City; of Lituya Bay, Alaska, 1894, and of Chilkat Inlet, and attended to some miscellaneous work.

Jesse Pawling, jr., reported for duty in the computing division March 29, 1895, and was engaged with computations of apparent places of stars; in computations of geographical positions, and other miscellaneous geodetic work.

Daniel Hurley attended to clerical duties, preparing copies of descriptions of trigonometric stations for use by field parties, and duplicating some leveling and other records. His efficiency is much impaired through ill health.

The following members of the field force were temporarily assigned to duty in this division:

A. L. Baldwin, from September 10, 1894, to January 21, 1895, was employed in computations of the triangulations of Atchafalaya, Cote Blanche, and Vermilion bays, adjusting and basing the work on modern data, and extending the computations to the Texas boundary work. The years comprised were 1882, 1885–1890.

F. A. Young, from September 10 to October 9, and reassigned from October 29 to December 27, 1894, was engaged in preparing abstracts of horizontal angles, Taku River triangulation, 1893, and in reducing spirit-level observations in Florida, 1894.

S. B. Tinsley, from September 26 to October 15, when he resigned, was engaged on spirit-level computations in Florida.

F. D. Granger reported for duty October 15, 1894; established and solved normal equations, computed astronomic azimuths on the Taku and Stikine rivers, prepared tables for the computation of geographic positions for printing, computed the azimuth at Fort Morgan, Ala., 1892, and computed positions on the Chilkat River, 1894. Assistant Granger was relieved of office duty December 19, 1894, and reported again for duty January 14, 1895, and up to May 16, 1895, was engaged on adjustments of horizontal angles, triangulation coast of California; on computing the traverse line south of Mount St. Elias, 1894, and in computing triangles and positions on Chilkat Inlet, 1894.

O. B. French, from November 6, 1894, to April 5, 1895, was engaged on computations of spirit-level work across Florida, 1892, and from Old Point Comfort to Richmond, Va., and assisted in computations connected with the survey of Chilkoot and Chilkat inlets, 1894.

J. Nelson, from November 12 to December 18, when ordered to field duty, computed geographical positions of coast triangulation, California, and attended to some magnetic reductions.

I. Winston reported for duty December 1, 1894, and between this date and March 25, 1895, when he resumed field duty, was occupied with preparing the results of spirit levels from Jefferson City, Mo., to Kansas City, Mo., for printing.

A. T. Mosman reported for duty January 7, 1895, and was engaged in the reduction of transit observations and telegraphic longitudes between Washington, D. C., and Gainesville, Fla., 1890; Washington and Augusta, Ga., 1890; and Washington and Jacksonville, Tex., 1890. Assistant Mosman reduced the transits and moon culminations observed at Camp Colonna, Alaska, 1889–90, and made good progress with the reductions of transit observations made at St. Michael, Alaska, 1890–91.

H. C. Denson was connected with this division from January 9 to May 15, 1895, when he joined a field party. He prepared abstracts of horizontal angles of the triangulation of Perdido Bay and River, and attended to miscellaneous geodetic computations to serve for introduction to some of the Survey methods.

L. G. Schultz reported for duty April 24 and engaged in the arrangement and examination of the magnetic records of San Antonio and Hill Side Ranch, Texas, 1890–1895, and commenced the tabulation of the monthly deflection observations. His services were discontinued June 1, 1895.

H. G. Ogden reported for duty June 20, and engaged in the reduction of spirit levels, but was ordered to take temporary charge of the engraving division on the 26th.

S. Hein, of the office of the assistant in charge, has given occasional but effective assistance during the month of June in copying descriptions of stations required by field parties.

Yours, respectfully,

CHARLES A. SCHOTT,
Assistant in Charge of Computing Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE TIDAL DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

TIDAL DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the tidal division for the fiscal year ending June 30, 1895:

SUMMARY OF THE WORK DONE DURING THE YEAR.

The Tide Tables for 1896 were prepared and submitted for publication. A number of important changes have been made in this work as compared with former years.

1. The name of the volume, which heretofore has been issued in two parts as "Atlantic" and "Pacific Coast Tide Tables," has been changed into "Tide Tables for 1896 by the United States Coast and Geodetic Survey."

2. The tables have been extended to the whole world; the number of subordinate stations given has been doubled, and the ports for which full predictions are made have been increased from a total of 23 for both coasts in 1895 to 70 in 1896. These principal ports are distributed over the seacoast of the world, as well as our present information in regard to tidal constants would permit; 2 are in Canada, 14 are on our Atlantic Coast, 2 on our Gulf Coast, 4 on our Pacific Coast, 2 in Alaska, 3 in South America, 2 in Japan, 4 in China, 3 in the Pacific Islands, 1 in New Zealand, 3 in Australia, 8 in southern Asia, 1 in Africa, 4 in France, 7 in England, 1 in Wales, 3 in Scotland, 5 in Ireland, and 1 in Germany.

3. The form for publishing the predicted tides, which has been devised by me, differs radically from any hitherto used. The tides are placed in the order of occurrence, as heretofore, but the

heights have been placed below their times, instead of to the right of them; the resulting condensation is such that three months, instead of one, are presented on a page.

4. The moon's phases, declination, apogee, and perigee are indicated on the days of their occurrence.

5. The time is reckoned from midnight without changing the count at noon; the hours less than 12 are in the morning; those greater are in the afternoon, and when diminished by 12 give the usual reckoning. This avoids all uncertainty as to morning or afternoon times, no matter how irregular the tides may be.

6. A brief treatise on tides has been added.

7. The subordinate stations have been arranged, as nearly as possible, in geographic order, going around the continents in the direction of the hands of a clock.

8. A column headed "Standard port for reference" has been added, which enables us to refer the station to that port for which full predictions are given which most nearly resembles it in type of tide.

9. The table of tidal constants was remodeled and extended, and in the explanation of tables various formulæ were added showing how to approximately derive a number of additional constants from those which are given.

10. An effort was made to indicate the interval and height of the diurnal tide wave in all parts of the earth, but owing to lack of sufficient data at present, little more than a beginning has been made in this volume.

Our Tide Tables now cover practically the entire seacoast of the world, but are far from being equally satisfactory for all ports, and we hope in future years to gradually replace the defective values as additional information is obtained.

The harmonic analyses, which had been begun before this fiscal year, have been completed for a year of hourly ordinations at Portland, Me., and old Point Comfort, Va., and for two sets of hourly ordinates at Philadelphia, Pa., consisting of five months in 1891, and eight months in 1892. Harmonic analyses from a year each of hourly ordinates have been made entirely during the year for Galveston, Tex.; Sitka, Alaska; and Buenos Ayres, Argentina. From high and low waters during one or two months harmonic analyses have been made for St. Johns, Newfoundland; Halifax, Nova Scotia; Baltimore, Md.; Cape Horn, South America; Tientsin entrance, Shanghai, and Amoy, China; Port Russell, New Zealand; Sidney and Melbourne, Australia; and Rochelle and Havre, France. The total work done on harmonic analysis during the year is the equivalent of the complete analysis of about five years of continuous records.

The nonharmonic reductions completed during the year consist of 27 series, the equivalent of about six years of continuous observations, which have been discussed by the first or interval reduction method; and of 12 series, the equivalent of about two years of continuous records, for which second or phase reductions, declination reductions, and parallax reductions have been made.

Tide notes have been prepared and furnished for 133 stations on 40 charts.

Requisitions from eight field parties have been filled, requiring the description of 47 bench marks, and tidal data for 26 stations.

Tidal information has been called for by 44 persons not connected with the Survey, the response to which required the preparation of 35 descriptions of bench marks, current tables for 5 stations, and tidal data for 105 stations, together with technical letters explaining tidal phenomenon.

An aggregate of about five years and eight months of record from automatic tide gauges has been received, examined, and registered. About two years of tabulated hourly heights of the sea, high and low waters, temperature and density of the sea, and meteorological data, as also 118 original and 114 duplicate volumes of tidal observations from staff and box gauges, were received.

The portion of a Manual on Tides, which was referred to in my last annual report, was completed and submitted for publication last December. This has since appeared as Appendix No. 7, Report for 1894. On account of the extension of the tide tables already referred to, Mr. Harris was diverted from original work, so that he has been able to little more than begin the continuation of the manual during the fiscal year.

A general idea of a new tide predictor, which would combine the desirable features of the Thomson and Ferrel machines, was outlined by Mr. Harris in Appendix No. 7, Report for 1894.

During the present year he developed this scheme a little more fully and submitted a rough plan of it to the instrument board of this Survey. The instrument and tidal divisions were instructed to cooperate in preparing sufficient details to afford a basis for estimating the probable cost of constructing a tide predictor; the former selecting such mechanical devices as seemed best adapted to the purposes of the proposed machine, and making the necessary drawings, while the latter was to furnish a list of components, with their greatest amplitudes, and the number of teeth which would give their proper speeds. It was finally decided to undertake the construction of the tide predictor as thus proposed, the distinguishing features of which are that it will show, simultaneously and accurately, both times and heights upon the face of the machine, as well as trace a tidal curve with marks upon its axis to indicate the exact times of the maxima and minima.

PERSONNEL OF THE TIDAL DIVISION.

Mr. L. P. Shidy, acting chief throughout the year.
Mr. F. M. Little, employed all the year.
Mr. R. A. Harris, employed all the year.
Miss Alice G. Reville, employed all the year.
Mrs. Virginia Harrison employed all the year.
Miss Florence Brower (Mrs. F. B. Burlingame), employed from July 1, 1894, to January 23, 1895.*
Mr. Deane S. Bliss, employed on probation from April 26 to June 30, 1895.
Mr. F. V. Moss, temporarily employed from July 1 to July 15, 1894.
Miss Gertrude Harrison, temporarily employed, March 13 to June 30, 1895.
Mr. F. C. Kendrick, temporarily employed, May 18 to June 30, 1895.
Mr. James A. Dorsey, employed as messenger, and assisted in adding and copying, October 20, 1894, to June 30, 1895.
Mr. D. Hurley, clerk of the computing division, was employed during the month of March copying our predictions.

In consequence of the great amount of labor incident to the preparation of the Tide Tables for 1896, the following field officers were assigned to this division for the periods mentioned:

Mr. G. R. Putnam, January 30 to April 24, 1895.
Mr. C. C. Yates, January 30 to April 3, 1895.
Mr. E. D. Preston, February 19 to March 12, 1895.
Mr. F. W. Perkins, February 27 to March 16, 1895.
Mr. F. A. Young, February 28 to April 24, 1895.
Mr. W. I. Vinal, April 17 to June 15, 1895.
Mr. Stehman Forney, May 6 to 23 and June 5 to 15, 1895.

CONCLUDING REMARKS.

It is very much to be desired that the estimate of expenses for 1896 be made to include provision for at least two additional tidal computers; such an increase of employees would enable us to greatly improve the values given in our Tide Tables and on the charts, for, as mentioned in my last annual report, the working force of this division for many years past has been entirely inadequate for really satisfactory service. It was found necessary to have the whole regular force of the division work overtime in order to complete the manuscript Tide Tables for 1896, and it gives me pleasure to testify to their general zeal and industry.

Respectfully, yours,

L. P. SHIDY,
Acting Chief of the Tidal Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

* Miss Brower, having married in July, was reappointed as Mrs. F. B. Burlingame; although reckoned as only a writer on the pay roll, she was an exceptionally good computer, and her resignation was a real loss to our service.

REPORT OF THE DRAWING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

DRAWING DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the report of the drawing division for the past fiscal year.

The drawing division was under the charge of Assistant W. H. Dennis until the 8th of May, 1895, when he was relieved by Assistant A. T. Mosman, who acted as chief of the division until June 16, at which date I was put in charge.

The same draftsmen who were employed at the close of the fiscal year 1894 continued their service through the past year, with the exception of Mr. G. F. Pohlers, who was dropped from the rolls on August 31, 1894.

The disposal of the current work among the draftsmen has been about as follows:

Mr. A. Lindenkohl has attended to the corrections of the charts rendered necessary by recent surveys and examinations, especially those called for by the work of the Army engineers upon river and harbor improvements. He has also continued to prepare the progress sketches for the annual report, and to construct the projections on copperplates. When not otherwise employed he has made an examination of the temperature and specific gravity observations made by the Survey in the waters of the Gulf of Mexico and the Gulf Stream, and prepared a sketch with report on these subjects.

Messrs. H. Lindenkohl, E. H. Fowler, D. M. Hildreth, C. H. Deetz, G. F. Pohlers, E. P. Ellis, and W. R. Doores, have been mostly engaged upon drawings of harbor charts for publication by photolithography. Among the most noticeable of these may be mentioned a chart of the coast of California near Point Pinos; one of Sitka Harbor; Charleston Harbor; a series of charts of the Connecticut River to Hartford; a map of the District of Columbia, scale 1-9600; and several additions to the series of charts comprising the north shore of Long Island Sound.

Mr. E. J. Sommer has continued to make computations of triangulations in Alaska; to make drawings for the series of charts of the Alexander Archipelago, and to prepare information for the field parties in Alaska. Since March, 1895, his attention has been principally devoted to the construction of an atlas of the Alaska boundary, called for by the Joint Boundary Commission.

Messrs. Fowler and Hildreth have prepared the greater number of projections applied for by field parties.

Messrs. Deetz, Ellis, and Doores have drawn a number of illustrations and diagrams for the report, and the last two mentioned and Mr. P. von Erichsen have usually made the tracings of surveys in answer to applications for information.

Mr. von Erichsen, besides the employment just mentioned, has been engaged upon inking plane-table sheets, measuring areas, mechanical drawings, and other miscellaneous duties.

Mr. Charles Mahon has been employed on clerical work.

During the past year the practice has been continued of retaining the tracings made in the office in answer to calls for information, and sending blue prints instead, whenever that could be done with propriety. In this way quite a respectable number of copies of topographic sheets has been obtained, which may serve many other purposes.

The general work of the division during the year may be summarized as follows:

Drawings were completed for 22 new charts to be photolithographed, and the drawings for 6 charts are in progress.

The drawings of 43 charts were revised and corrected for the new editions. In addition to this work there were revised and corrected for reprints the drawings of 85 charts.

The usual diagrams, sketches, and illustrations were drawn or revised for the report of the superintendent.

Twenty topographic and 35 hydrographic projections were constructed, and 51 projections on copperplates.

Twenty-one topographic sheets were inked and lettered, and a sheet containing all deep-sea soundings of the northwest Atlantic brought up to date.

Fifty-seven calls for information were received from the various Departments, and from the public, for which blue prints, tracings, or other information were furnished, a detailed list of which is hereto attached.

In conclusion, I beg leave to state that although the number of draftsmen has been found sufficient to answer promptly to all calls for their services from other divisions of the office, as well as from other parties, it has been found none too large to secure the desirable dispatch in the publication of new surveys and in the incorporation upon our charts of important information, such as is almost daily received, which dispatch is extremely desirable, equally on account of the reputation of the institution, the safety of navigation and the dissemination of useful knowledge.

Respectfully, yours,

WILL WARD DUFFIELD,
Assistant in Charge of the Drawing Division.

Mr. ANDREW BRAID,
Assistant in Charge of Office and Topography.

REPORT OF THE ENGRAVING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

ENGRAVING DIVISION, *June 30, 1895.*

SIR: I respectfully submit the following report of the operations of this division during the fiscal year ending June 30, 1895. The statistics are as follows:

ENGRAVING.

Number of new charts completed	16
Number of new editions of charts completed	23
Number of sketches and illustrations completed	7
Number of new printing plates reissued	2
Thirteen section maps of the District of Columbia completed, 4 plates each	52
Number of new charts commenced	6
Number of new additions of charts commenced	21
Number of sketches and illustrations commenced	3
Ten section maps of the District of Columbia commenced, 4 plates each	40
Number of new printing plates, reissue commenced	1
Number of chart plates corrected for printing	428
Number of chart plates printed for the chart room	709
Number of sketches and illustrations corrected for printing	31
Number of plates in progress during the year, not completed	47
Number of unfinished plates on hand at the close of the year, viz:	
New charts	15
New editions of charts	13
Sketches and illustrations	17
Five section maps of the District of Columbia, 4 plates each	20

ELECTROTYPING.

Number of pounds of copper deposited		1 912¼
Number of square inches on which deposit was made		77 458
Number of plates made, viz:		
Basso plates	28	
Alto plates	35	
		63

Of this number, one basso and one alto plate were made for the State Department, the "Declaration of Independence."

PHOTOGRAPHING.

Number of negatives made	122
Number of blue prints made	889
Number of silver prints made	165
Number of lantern slides made for archives, northwest boundary, etc	61
Number of nigrosine, or black prints made	32
Number of enlarged prints of Alaska views	35

PRINTING.

Number of impressions for the chart rooms	37 289	
Number of impressions for Assistant in charge of Office	4 005	
Number of impressions for hydrographic inspector	74	
Number of impressions for engra.ing division	458	
Number of impressions for lithographers (transfer proofs)	125	
Total number of impressions		41 951

The force of engravers was reduced very materially during the year by the resignation of Mr. A. Petersen, the absence, on account of sickness, of Mr. E. J. Enthoffer, and the death of Mr. Gilbert F. Dawson, and for a time the suspension of three extra engravers—William Mackenzie, Peter H. Geddes, and David Morris, the first two from December 28, 1894, to March 7 and April 19, 1895—which lessened the output of work very much. Otherwise the force has continued through the fiscal year as heretofore reported.

The old, or expert, engravers have been employed on the branches of the work that they have made specialties, with the exception of such interruption as was necessary through the corrections arising from resurveys and work necessary to prepare the plates for publication.

Contracts for engraving were given out during the latter part of the year to Messrs. R. F. Bartle & Son, of this city, to engrave ten plates, viz:

Catalogue No.	Title.	Scale.
200	Vermilion Bay to Pecan Island	1–80 000
213	Nantucket Shoals, Massachusetts	1–80 000
247	Hyannis Harbor	1–20 000
271	Rye Neck to New Rochelle	1–10 000
362	New Haven Harbor, Connecticut	1–20 000
353[2]	Newport Harbor	1–20 000
5525	Mare Island Strait	1–10 000
6303	Port Angeles	1–10 000
6185	Willapa Bay	1–40 000
8240	Sitka Sound	1–80 000

And also ten sets of topographical sheets of the District of Columbia survey, 40 plates, Sheets Nos. 25, 26, 27, 28, 35, 9, 10, 19, 20, and 29, scale $\frac{1}{4\,800}$, and Progress Sketch No. 16, Utah and Nevada, scale $\frac{1}{1\,000\,000}$.

The most important charts completed during the year are as follows:

Catalogue No. 6, Quoddy Head to Cape Cod, scale $\frac{1}{400\,000}$, completing that series on the coast of Maine.

Catalogue No. 120, New York Bay and Harbor, scale $\frac{1}{80\,000}$, showing all improvements up to date.

Catalogue No. 300, Passamaquoddy Bay and St. Croix River, scale $\frac{1}{40\,000}$, completing the series of $\frac{1}{40\,000}$ charts on the coast of Maine.

Catalogue No. 384, Baltimore Harbor and approaches, scale $\frac{1}{40\,000}$, being a resurvey, and showing the improvements of the harbor, by the engineer of the harbor board of Baltimore.

Catalogue No. 400, Hampton Roads, Virginia, scale $\frac{1}{20\,000}$, being a large scale chart engraved on copper in the place of a photolithograph.

Chart No. 8, San Francisco to Bering Sea, scale $\frac{1}{3\,600\,000}$, showing all improvements up to date, including the isogonic lines.

Catalogue No. 8 100, Clarence Strait, Revillagigedo Channel, and Portland Canal.

Catalogue No. 8 200, Frederick Sound and Sumner Strait.

Catalogue No. 8 300, Lynn Canal and Stephens Passage, being copperplate engraving, showing corrections of surveys up to date.

There were also completed and published during the year four charts, new editions, showing extensive and important corrections, viz:

Catalogue No.	Title.	Scale.
155	Hunting Island to Ossabaw Island	1–80 000
156	Savannah to Sapelo Island.	1–80 000
44	Tybee Roads, Savannah River and Wassaw Sound.*	1–40 000
431	Charleston Harbor†	1–30 000

*Showing the improvements of the Savannah River by the United States Engineers up to December, 1894.
†Showing the surveys made by Assistants J. W. Donn, W. C. Hodgkins, and C. H. Boyd in 1894.

In fact, the number of original charts and plates of new editions of charts completed during the year is much larger than has heretofore been reported, and embraces a great deal of new work and recent surveys.

A large number of important plates were continued during the year, and many of them advanced so far that they will be completed and published at an early date.

The requisitions for printing made by the chart rooms have been in excess of the work done by over 4 500 sheets, as compared with the work done for the fiscal year ending June 30, 1894, which is accounted for to a great extent by the printing, during the months of July and September, 1894, and March, 1895, of 2 677 sheets from the plates of the District of Columbia survey, 1 000 of which were registered, that is to say, that it required the printing of four plates to make one registered proof, equal to 4 000 proofs, consequently a great deal of time was consumed, say two months, that could otherwise have been devoted to the regular chart printing. The proofs were for the District of Columbia Engineer Commissioner, and for distribution by the chart division.

The registration of the photolithograph work has been continued in this division for the fiscal year ending June 30, 1895. Thirty-five new charts, new editions, new prints, and reprints were furnished during the year, making an aggregate of 10 000 copies, together with 500 copies of chart showing the tides and currents of East River and Hell Gate, and 500 pasters showing the resurvey of Charleston Harbor, and 5 000 copies of sheets Nos. 1, 2, 3, 4, and 6 of the District of Columbia survey, enlarged four times.

The plate printing office was continued under the direction of Mr. F. Moore, foreman, until April 9, 1895, when he was taken sick, and was run by Mr. Charles J. Harlow, acting foreman, until the 20th day of June, 1895, when Mr. D. N. Hoover, a former printer of the establishment, was appointed foreman. The force of the printers and helpers has remained unchanged, with the exception of the removal of Abraham D. Levi, printer, March 31, 1895, and the appointment of George B. Crawford, a former printer in the office, in his place, April 1, 1895.

The electrotype and photograph rooms were continued under the direction of Mr. D. C. Chapman, assisted by Mr. L. P. Keyser, until the death of Mr. Chapman, January 3, 1895, and on the 1st day of February, 1895, Mr. Keyser was appointed on probation. On the 14th of June, 1895, he was appointed in Mr. Chapman's place, the appointment taking effect July 1, 1895.

The promotion of Mr. Keyser on probation caused a vacancy in the position of helper in the laboratory, which was filled by the appointment of Mr. Roy Thomas, February 15, 1895.

The general work of the division has been performed by Mr. John H. Smoot, in his usual acceptable manner; and the correspondence and detail work in regard to photolithographing, by Mr. Eugene Rhodes, who performed his duties very satisfactorily until September 30, 1894, when his connection with the Survey ceased. On the 5th day of February, 1895, Mr. John H. Hobgood, writer, was assigned to the division, on probation, and has rendered very satisfactory service.

The chief of the division, H. G. Ogden, having been ordered on special duty June 9, 1894, making a resurvey of Boston Harbor, did not take charge of the division the entire fiscal year,

except for four days, from June 26 to 29, inclusive, when the acting chief, George A. Fairfield, had been relieved; otherwise Mr. Fairfield performed the duties as acting chief the entire year.

The following statistical tables show in detail the work of various classes executed by the division during the year:

Catalogue No.	Plate No.	Title.	Scale.
		ORIGINAL PLATES COMPLETED.	
6	2349	Quoddy Head to Cape Cod	1-400 000
111	2393	Nantucket Sound and eastern approaches	1-80 000
120	2184	New York Bay and Harbor	1-80 000
172	2196	Cape Sable to Seminole Point	1-80 000
300	2356	Passamaquoddy Bay and St. Croix River	1-40 000
343	2390	Nantucket Harbor	1-10 000
346	2396	Edgartown Harbor	1-20 000
361[4]	2346	Port Jefferson, Long Island	1-10 000
375	2333	Raritan River, Raritan Bay to New Brunswick	1-20 000
384	2247	Baltimore Harbor and approaches	1-40 000
400	2281	Hampton Roads	1-20 000
S	2363	San Francisco to Bering Sea	1-3 600 000
6462	2326	Olympia Harbor, Puget Sound	1-20 000
8100	2354	Clarence Strait, Revillagigedo Channel, etc	1-200 000
8200	2361	Frederick Sound and Sumner Strait	1-200 000
8300	2362	Lynn Canal and Stephens Passage	1-200 000
		NEW EDITIONS COMPLETED.	
15	2049	Straits of Florida	1-400 000
18	1780	Cape San Blas to Mississippi Passes	1-400 000
115	2005	Plum Island to Stratford Shoal	1-80 000
116	2006	Stratford Shoal to New York	1-80 000
135	1947	Choptank River to Magothy River	1-80 000
155	1946	Hunting Island to Ossabaw Island	1-80 000
156	1341	Savannah to Sapelo Island	1-80 000
167	2380	From The Elbow to Lower Matecumbe Key	1-80 000
168	2188	Long Key to Newfound Harbor Key	1-80 000
176	1990	Lemon Bay to Tampa Bay	1-80 000
188	2306	Mobile Bay and entrance	1-80 000
189	2314	Mobile entrance and eastern part of Mississippi Sound	1-80 000
194	1845	From the Passes to Grand Prairie	1-80 000
379	1944	Cape Henlopen and the Delaware Breakwater	1-20 000
384	2406	Baltimore Harbor and approaches	1-40 000
431	2306	Charleston Harbor	1-30 000
440	1934	Tybee Roads and Savannah River	1-40 000
477	1400	Tampa Bay	1-40 000
5106	2395	San Diego Bay	1-40 000
5050	2029	San Francisco Bay to Straits of Juan de Fuca	1-1 200 000
8000	1880	Dixon entrance to Cape St. Elias	1-1 200 000
8500	1133	Icy Bay to Semidi Islands	1-1 200 000
T	2408	General chart of Alaska	1-3 600 000
		REISSUES COMPLETED.	
109	2364	Boston Bay and Harbor	1-80 000
369	2387	New York Bay and Harbor, upper	1-40 000
		MISCELLANEOUS PLATES COMPLETED.	
	2321	Base map, triangulation between western Nevada and Pacific coast	
	2392	Base map, triangulation between western Nevada and Pacific coast	
	2397	Base map, title and notes	
	2399	Sketch of distribution of the principal astronomic stations.	
	2351	Base map of Alaska	1-13 700 000
	2402	Base map of Alaska, isogonic lines	1-13 700 000
	2405	Base map of Alaska, stations	1-13 700 000
		DISTRICT MAPS COMPLETED.	
5	2365	Map of the District of Columbia, roads	1-4 800
5	2365	Map of the District of Columbia, water	1-4 800

Catalogue No.	Plate No.	Title.	Scale.
		DISTRICT MAPS COMPLETED—continued.	
5	2365	Map of the District of Columbia, woods	1–4 800
5	2365	Map of the District of Columbia, curves	1–4 800
6	2366	Map of the District of Columbia, roads	1–4 800
6	2366	Map of the District of Columbia, water	1–4 800
6	2366	Map of the District of Columbia, woods	1–4 800
6	2366	Map of the District of Columbia, curves	1–4 800
7	2367	Map of the District of Columbia, roads	1–4 800
7	2367	Map of the District of Columbia, water	1–4 800
7	2367	Map of the District of Columbia, woods	1–4 800
7	2367	Map of the District of Columbia, curves	1–4 800
8	2368	Map of the District of Columbia, roads	1–4 800
8	2368	Map of the District of Columbia, water	1–4 800
8	2368	Map of the District of Columbia, woods	1–4 800
8	2368	Map of the District of Columbia, curves	1–4 800
15	2374	Map of the District of Columbia, roads	1–4 800
15	2374	Map of the District of Columbia, water	1–4 800
15	2374	Map of the District of Columbia, woods	1–4 800
15	2374	Map of the District of Columbia, curves	1–4 800
16	2375	Map of the District of Columbia, roads	1–4 800
16	2375	Map of the District of Columbia, water	1–4 800
16	2375	Map of the District of Columbia, woods	1–4 800
16	2375	Map of the District of Columbia, curves	1–4 800
17	2376	Map of the District of Columbia, roads	1–4 800
17	2376	Map of the District of Columbia, water	1–4 800
17	2376	Map of the District of Columbia, woods	1–4 800
17	2376	Map of the District of Columbia, curves	1–4 800
18	2377	Map of the District of Columbia, roads	1–4 800
18	2377	Map of the District of Columbia, water	1–4 800
18	2377	Map of the District of Columbia, woods	1–4 800
18	2377	Map of the District of Columbia, curves	1–4 800
25	2382	Map of the District of Columbia, roads	1–4 800
25	2382	Map of the District of Columbia, water	1–4 800
25	2382	Map of the District of Columbia, woods	1–4 800
25	2382	Map of the District of Columbia, curves	1–4 800
26	2383	Map of the District of Columbia, roads	1–4 800
26	2383	Map of the District of Columbia, water	1–4 800
26	2383	Map of the District of Columbia, woods	1–4 800
26	2383	Map of the District of Columbia, curves	1–4 800
27	2384	Map of the District of Columbia, roads	1–4 800
27	2384	Map of the District of Columbia, water	1–4 800
27	2384	Map of the District of Columbia, woods	1–4 800
27	2384	Map of the District of Columbia, curves	1–4 800
28	2385	Map of the District of Columbia, roads	1–4 800
28	2385	Map of the District of Columbia, water	1–4 800
28	2385	Map of the District of Columbia, woods	1–4 800
28	2385	Map of the District of Columbia, curves	1–4 800
35	2386	Map of the District of Columbia, roads	1–4 800
35	2386	Map of the District of Columbia, water	1–4 800
35	2386	Map of the District of Columbia, woods	1–4 800
35	2386	Map of the District of Columbia, curves	1–4 800
		PLATES COMMENCED, ORIGINALS.	
200	2418	Vermilion Bay to Pecan Island	1–80 000
250	2400	Eastern entrance to Nantucket Sound	1–40 000
271	2419	Rye Neck to New Rochelle	1–10 000
362	2416	New Haven Harbor	1–20 000
6400	2403	Seacoast and interior harbors of Washington	1–300 000
8240	2414	Sitka Sound, Alaska	1–80 000
		NEW EDITIONS OF PLATES COMMENCED.	
15	2049	Straits of Florida	1–400 000
18	1780	Cape San Blas to the Mississippi Passes	1–400 000
115	2005	Long Island Sound, Plum Island to Stratford Shoal	1–80 000
116	2006	Long Island Sound, Stratford Shoal to New York	1–80 000
155	1946	Hunting Island to Ossabaw Island	1–80 000
156	1341	Savannah to Sapelo Island	1–80 000
175	2413	San Carlos Bay to Lemon Bay, including Charlotte Harbor	1–80 000
176	1990	Lemon Bay to Tampa Bay	1–80 000
194	1845	Mississippi River, from the Passes to Grand Prairie	1–80 000
331	2410	Newburyport Harbor	1–20 000
379	1944	Cape Henlopen and the Delaware Breakwater	1–20 000

Catalogue No.	Plate No.	Title.	Scale.
		NEW EDITIONS OF PLATES COMMENCED—continued.	
384	2406	Baltimore Harbor and approaches	1-40 000
431	2306	Charleston Harbor	1-30 000
440	1934	Tybee Roads, Savannah River, and Wassaw Sound	1-40 000
469	2415	Key West Harbor	1-50 000
477	1400	Entrance to Tampa Bay	1-40 000
5106	2395	San Diego Bay, California	1-40 000
5050	2029	San Francisco Bay to the Strait of Juan de Fuca	1-1 200 000
8000	1880	Dixon entrance to Cape St. Elias	1-1 200 000
8500	1133	Icy Bay to Semidi Islands	1-1 200 000
T	2408	General chart of Alaska	1-3 600 000
		REISSUES COMMENCED.	
369	2387	New York Bay and Harbor	1-40 000
		MISCELLANEOUS, COMMENCED.	
	2397	Plate of title and notes for progress sketches	
	2402	Base map of Alaska, isogonic lines	
	2405	Base map of Alaska, stations	
		DISTRICT OF COLUMBIA SURVEY.	
25	2382	Map of the District of Columbia, roads	1-4 800
25	2382	Map of the District of Columbia, water	1-4 800
25	2382	Map of the District of Columbia, woods	1-4 800
25	2382	Map of the District of Columbia, curves	1-4 800
26	2383	Map of the District of Columbia, roads	1-4 800
26	2383	Map of the District of Columbia, water	1-4 800
26	2383	Map of the District of Columbia, woods	1-4 800
26	2383	Map of the District of Columbia, curves	1-4 800
27	2384	Map of the District of Columbia, roads	1-4 800
27	2384	Map of the District of Columbia, water	1-4 800
27	2384	Map of the District of Columbia, woods	1-4 800
27	2384	Map of the District of Columbia, curves	1-4 800
28	2385	Map of the District of Columbia, roads	1-4 800
28	2385	Map of the District of Columbia, water	1-4 800
28	2385	Map of the District of Columbia, woods	1-4 800
28	2385	Map of the District of Columbia, curves	1-4 800
35	2386	Map of the District of Columbia, roads	1-4 800
35	2386	Map of the District of Columbia, water	1-4 800
35	2386	Map of the District of Columbia, woods	1-4 800
35	2386	Map of the District of Columbia, curves	1-4 800
9	2404	Map of the District of Columbia, roads	1-4 800
9	2404	Map of the District of Columbia, water	1-4 800
9	2404	Map of the District of Columbia, woods	1-4 800
9	2404	Map of the District of Columbia, curves	1-4 800
10	2409	Map of the District of Columbia, roads	1-4 800
10	2409	Map of the District of Columbia, water	1-4 800
10	2409	Map of the District of Columbia, woods	1-4 800
10	2409	Map of the District of Columbia, curves	1-4 800
19	2411	Map of the District of Columbia, roads	1-4 800
19	2411	Map of the District of Columbia, water	1-4 800
19	2411	Map of the District of Columbia, woods	1-4 800
19	2411	Map of the District of Columbia, curves	1-4 800
20	2412	Map of the District of Columbia, roads	1-4 800
20	2412	Map of the District of Columbia, water	1-4 800
20	2412	Map of the District of Columbia, woods	1-4 800
20	2412	Map of the District of Columbia, curves	1-4 800
29	2420	Map of the District of Columbia, roads	1-4 800
29	2420	Map of the District of Columbia, water	1-4 800
29	2420	Map of the District of Columbia, woods	1-4 800
29	2420	Map of the District of Columbia, curves	1-4 800
		UNFINISHED CHARTS CONTINUED.	
191	906	Lakes Borgne and Pontchartrain	1-80 000
197	2372	Southwest Light to Ship Island Shoal	1-80 000
199	2373	Point au Fer to Marsh Island	1-80 000
200	2418	Vermilion Bay to Pecan Island	1-80 000
250	2400	Eastern entrance to Nantucket Sound	1-40 000
271	2419	Rye Neck to New Rochelle	1-10 000
348	2332	Woods Holl	1-10 000

Catalogue No.	Plate No.	Title.	Scale.
		UNFINISHED CHARTS—continued.	
353[2]	2344	Newport Harbor, etc	1-20 000
362	2416	New Haven Harbor, Connecticut	1-20 000
6405	2352	Port Townsend, Washington	1-20 000
6300	2119	Strait of Juan de Fuca	1-200 000
6400	2403	Seacoast and interior harbors of Washington	1-300 000
5795	2330	Cape Mendocino and vicinity	1-40 000
8240	2414	Sitka Sound, Alaska	1-80 000
6441	2166	Seattle Harbor	1-20 000
114	1969	Newport to Plum Island	1-80 000
115	2162	Plum Island to Stratford Shoal	1-80 000
116	2154	Stratford Shoal to New York	1-80 000
126	1935	Delaware River, Penns Neck to Philadelphia	1-80 000
134	1992	Potomac River to Choptank River	1-80 000
175	2413	San Carlos Bay to Lemon Bay	1-80 000
353	2359	Narragansett Bay, Upper	1-40 000
353	2360	Narragansatt Bay, Lower	1-40 000
369	2370	New York Bay and Harbor, Upper	1-40 000
369	2371	New York Bay and Harbor, Lower	1-40 000
428	4345	Winyah Bay and Georgetown Harbor	1-40 000
469	2515	Key West Harbor	1-50 000
5100	1534	San Diego to Santa Monica	1-200 000
		PROGRESS SKETCHES, UNFINISHED.	
12	2316	Sketch No. 12, Pennsylvania, New Jersey, and Virginia	1-1 000 000
16	2317	Sketch No. 16, Nevada and Utah, rivers	1-1 000 000
16	2338	Sketch No. 16, Nevada and Utah, triangulation	1-1 000 000
	2350	General base map of the United States, rivers	
		DISTRICT OF COLUMBIA SURVEY, UNFINISHED.	
9	2404	Map of the District of Columbia, roads	1-4 800
9	2404	Map of the District of Columbia, woods	1-4 800
9	2404	Map of the District of Columbia, water	1-4 800
9	2404	Map of the District of Columbia, curves	1-4 800
10	2409	Map of the District of Columbia, roads	1-4 800
10	2409	Map of the District of Columbia, woods	1-4 800
10	2409	Map of the District of Columbia, water	1-4 800
10	2409	Map of the District of Columbia, curves	1-4 800
19	2411	Map of the District of Columbia, roads	1-4 800
19	2411	Map of the District of Columbia, woods	1-4 800
19	2411	Map of the District of Columbia, water	1-4 800
19	2411	Map of the District of Columbia, curves	1-4 800
20	2412	Map of the District of Columbia, roads	1-4 800
20	2412	Map of the District of Columbia, woods	1-4 800
20	2412	Map of the District of Columbia, water	1-4 800
20	2412	Map of the District of Columbia, curves	1-4 800
29	2420	Map of the District of Columbia, roads	1-4 800
29	2420	Map of the District of Columbia, woods	1-4 800
29	2420	Map of the District of Columbia, water	1-4 800
20	2420	Map of the District of Columbia, curves	1-4 800
		ATLANTIC COAST.	
	1717	Atlantic Coast Pilot views, etc	
	1718	Atlantic Coast Pilot views, etc	
	1702	Atlantic Coast Pilot views, etc	
	1720	Atlantic Coast Pilot views, etc	
	1721	Atlantic Coast Pilot views, etc	
	1873	Atlantic Coast Pilot views, etc	
	1874	Atlantic Coast Pilot views, etc	
	1723	Atlantic Coast Pilot views, etc	
	1728	Atlantic Coast Pilot views, etc	
	1744	Atlantic Coast Pilot views, etc	
	1705	Atlantic Coast Pilot views, etc	
	1781	Atlantic Coast Pilot views, etc	
	1763	Atlantic Coast Pilot views, etc	

Statement of electrotyping for the fiscal year from July 1, 1894, to June 30, 1895.

Date.	Number of pounds of copper deposited.	Number of square inches upon which deposit was made.	For the Coast Survey.		For the State Department.	
			Altos.	Bassos.	Alto.	Basso.
1894.						
July	194	7 779	4	2		
August	220½	9 451	4	3		
September	209	6 409	2	5		
October	117	3 089	2	3		
November	78	3 859	4			
December	130½	6 165	3	1	1	
1895.						
January	91	3 809	1	1		1
February	137½	5 712	2	3		
March	172	6 237	3	2		
April	124	5 559	4	1		
May	225	10 996	4	2		
June	214	8 393	1	4		
Total	1 912½	77 458	34	27	1	1

Statement of photographing, from July 1, 1894, to June 30, 1895.

Date.	Negatives.	Blue prints.	Nigrosine prints.	Lantern slides of Northwest Boundary for archives.	Silver prints.	Enlarged prints of Alaska views.
1894.						
July	4	150				
August	1	32				
September		12	12			
October	4	48				
November	48	162			49	35
December	8	166			53	
1895.						
January	2	2	8	21	15	
February	11	21	11			
March	5	17	1	40		
April	9	50				
May	13	172			48	
June	17	57				
Total	122	889	32	61	165	35

Statement of printing from July 1, 1894, to June 30, 1895.

Date.	Chart room.	Engraving division.		Hydrographic Office.	Ordered by Office.	Old files.	For the lithographer.	Proofs of District plates.	For the Supreme Court.	For the State Department.	Proofs condemned.	Total printing.
		Files.	Verification.									
1894.												
July	2 276	12	28		51	8		441				2 816
August	2 874	2	40		62			62				3 040
September	1 710	1	41		98		28	649				2 527
October	1 954	9	48		64			181				2 256
November	2 711		49		76		34	14	61			2 945
December	2 594		22	3	52		14	13				2 698
1895.												
January	4 121	4	18		85		33					4 261
February	3 305	3	20		87		10	28		12		3 465
March	3 239	10	22		54			1 587			116	5 028
April	3 907	5	64	45	88		4					4 113
May	3 520		27	26	61							3 634
June	5 078		25		63		2					5 168
Total	37 289	46	404	74	841	8	125	2 975	61	12	116	41 951

Number of plates printed from for the chart room from July 1, 1894, to June 30, 1895.

Date.	32-inch press.	36-inch press.	37-inch press, new.	37-inch press, old.	38-inch press, new.	38-inch press, old.	Total printing.
1894.							
July		8	4	10	10		32
August		18	19	16	7		60
September		5	19	20		4	48
October		11	16	11	10	1	49
November		19	25	19	10	1	74
December		24	15	4	10		53
1895.							
January		26	15	19	12		72
February		19	17	14	17	2	69
March		17	15	12	2	6	52
April	6	22	14	20	14	7	83
May		11	5	25	8	2	51
June		17	21	14	14		66
Total	6	197	185	184	114	23	709

Four hundred and twenty-eight plates corrected for printing.

Respectfully, yours,

WILL WARD DUFFIELD,
Assistant and Chief of the Drawing Division.

MR. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE CHART DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

CHART DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the chart division for the fiscal year ending June 30, 1895:

This division has been under my charge during the year, and the following-named persons have been attached to it, whose general duties have been as noted:

Miss L. A. Mapes, bookkeeping and correspondence.
Mr. H. R. Garland, issuing and correcting charts.
Mr. J. H. Barker, correcting charts.
Miss M. L. Handlan, coloring charts.
Mr. Neil Bryant, receiving and stamping charts.
Mr. A. G. Randall, correcting charts.
Mr. H. Sidney King, coloring and correcting charts.
Mr. J. K. Hagmann, messenger.
Mr. A. Upperman, mounting sheets and joining charts.
Mr. Preston Boisseau, messenger.
Mr. J. A. Dorsey, coloring charts.
Mrs. Mary L. Godwin, coloring charts.
Mr. John W. Miner, messenger.

The changes in the force have been as follows:

Mr. J. K. Hagmann, dismissed July 11.
Mr. Preston Boisseau, assigned July 25.
Mr. H. Sidney King, transferred to division of library and archives August 15.
Mr. J. A. Dorsey, detailed to other duty in Office September 25.
Mr. J. H. Barker, died October 31.
Mr. Preston Boisseau, transferred to division of library and archives April 27.
Mrs. Mary L. Godwin, assigned on April 26, and was detailed for duty at the Treasury Department on May 1, and was permanently transferred to that Department on July 1.
Mr. John W. Miner, assigned April 29; transferred to other duty in office June 6.
Mr. Preston Boisseau, assigned June 7.

Misses Mapes and Handlan and Messrs. Bryant, Garland, Randall, Upperman, and Boisseau are now on duty in the division.

The following persons were temporarily assigned in the month of July from other divisions in the Office:

Mr. Daniel Hurley, coloring charts, two days, from computing division.
Mr. H. R. McCabe, correcting charts, ten days, from engraving divison.
Mr. G. Hergesheimer, correcting charts, ten days, from engraving division.
Mr. H. Thompson, correcting charts, ten days, from engraving division.

The force in this division has been too small to properly attend to the work assigned to it, having been only seven in number from November to June, inclusive, in consequence of which there was unavoidable delay in filling orders, and especially so in May and June when the call for charts is comparatively large. There should be nine persons in the force, which would even then be smaller by one or two than in the years from 1889 to 1893.

The following table represents in brief the more important features of the relation of the chart issue of this year to that of the six years next preceding:

Comparison of issues of charts during the fiscal years noted.

Year.	Total.		Free distribution.		Gross sales.		Net sales.	
	Copies.	Values.	Copies.	Values.	Copies.	Values.	Copies.	Values.
1889	49 312	$20 096	21 088	$8 266	28 224	$11 830	26 540	$11 280
1890	63 152	26 178	30 112	12 121	33 040	14 057	31 806	13 575
1891	52 959	23 457	20 811	8 846	32 148	14 611	28 473	13 141
1892	52 675	23 041	23 451	9 831	29 224	13 209	27 214	12 506
1893	55 026	24 215	27 310	11 805	27 716	12 409	25 366	11 605
1894	51 671	22 476	22 702	11 845	23 969	10 631	21 230	9 595
1895	51 456	22 280	24 892	10 507	26 564	11 773	23 136	10 405

The total issue is a trifle smaller than that of last year, and 5 per cent smaller than the average of the previous six years. The net sales, i. e., the gross sales less copies returned by sales agents, have increased 9 per cent in copies and 8 per cent in value as compared with the previous year, and are 13 per cent less in copies and value than those of the previous six years.

The distribution of charts to libraries has been continued, as noted in the table of issues, etc., given further on.

A new edition of the chart catalogue was received in January, 1895, and about 1 500 copies have since been distributed.

The correspondence for the year has amounted to 3 558 letters written.

There have been delivered to this division for issue in the past year three new charts from copperplates and sixteen new lithographic charts and maps, nineteen in all, viz:

Date.	Catalogue No.	Title.
		ENGRAVED.
1894.		
July 25	198	Caillou Bay and Ship Shoal, Louisiana.
1895.		
Jan. 29	300	Passamaquoddy Bay and St. Croix River, Maine.
June 10	6	Quoddy Head to Cape Cod.
		LITHOGRAPHED.
1894.		
Oct. 3	3061	District of Columbia, No. 1, topographic map.
Oct. 3	3062	District of Columbia, No. 2, topographic map.
Oct. 3	3063	District of Columbia, No. 3, topographic map.
Oct. 3	3064	District of Columbia, No. 4, topographic map.
Oct. 3	3066	District of Columbia, No. 6, topographic map.
Oct. 25	8244	Sitka Harbor and approaches, Alaska.
Nov. 6	247	Hyannis Harbor, Massachusetts.
Dec. 13	8240	Sitka Sound, Alaska.
1895.		
Feb. 2	8050	Dixon entrance to head of Lynn Canal, Alaska.
Apr. 22	254	Connecticut River, Deep River to Higganum, Conn.
Apr. 29	255	Connecticut River, Higganum to Rocky Hill, Conn.
Apr. 29	5476	Pfeiffer Point to Cypress Point, California.
May 27	468	St. Johns River, Palatka to Lake Monroe, Florida.
May 31	266	Fairfield to Georges Rock, Connecticut.
June 19	265	East Bridgeport to Fairfield, Conn.
June 21	253	Connecticut River, entrance to Deep River, Connecticut.

Thirty nine new copper-plate editions of charts and eight new lithographic editions, forty-seven in all, have been delivered to this division for issue.

The receipts, issues, and general distribution of charts are given in the following tables:

	July 1, 1894, to June 30, 1895.	
	Number.	Value.
ISSUES OF CHARTS.		
Sales agents	25 635	$11 427·15
Sales by office and chart division	929	345·95
Congressional account	3 372	1 588·45
Hydrographic Office, Navy	9 570	4 017·10
Light-House Board	2 116	855·75
Coast and Geodetic Survey Office	3 243	1 410·45
Executive Departments	3 033	1 183·05
Foreign Governments	286	131·50
Libraries	2 237	824·30
Miscellaneous	1 035	495·95
Total	51 456	22 279·65
Condemned	7 712	3 122·65
Total issued and condemned	59 168	25 402·30
CHARTS ON HAND AND RECEIVED.		
On hand by count July 1, 1894	42 360	15 677·30
Received from engraving division	35 600	16 139·25
Received from lithographers	12 262	4 979·85
Returned	3 431	1 369·50
Total on hand and received	93 653	38 165·90
Total issued and condemned	59 168	25 402·30
On hand by book July 1, 1895	34 485	12 763·60
Difference between book and count	205	82·65
On hand by count July 1, 1895	34 280	12 680·95

Very respectfully, yours,

GERSHOM BRADFORD,
Assistant and Chief of the Chart Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE MISCELLANEOUS DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

MISCELLANEOUS DIVISION, *June 30, 1895.*

SIR: I have the honor to submit herewith the report of the miscellaneous division for the fiscal year ending June 30, 1895.

The volume of work done in the division, so far as it is susceptible of tabulation, is shown by the following figures:

Letters written (sales agents, 3 056; miscellaneous, 638)	3 694
Ledger accounts kept (sales agents)	97
Quarterly statements of sales agents examined and verified	282
Circulars to sales agents issued	28
Charts sent to sales agents	25 635
Orders for purchases issued	108
Requisitions made for printing and binding	96
Requisitions for stationery filled	426
Requisitions for miscellaneous supplies and repairs filled	209
Annual reports distributed (see tabulated statement)	2 947
Tide Tables issued	5 691
Atlantic Coast Pilots issued	4
Subdivisions, Atlantic Local Coast Pilot, issued	110

United States Coast Pilots, Atlantic Coast, issued	445
Pacific Coast Pilot, Alaska, Part I, issued	23
Pacific Coast Pilot, "California, Oregon, and Washington," issued	13

Two thousand and ninety-five more charts were sent to sales agents during the year than in the preceding year, being an increase of nearly 9 per cent.

Ten agencies for the sale of publications—eight on the Atlantic and Gulf coasts, and two on the Pacific Coast were established during the year, and four were discontinued, three on the Atlantic Coast and one on the Pacific Coast. The total number of agencies on June 30, 1895, was 90, 69 on the Atlantic and Gulf coasts and 21 on the Pacific Coast.

The following publications were sent to press: Annual Reports of the Superintendent for the fiscal years ended June 30, 1893, and June 30, 1894; United States Coast Pilot, Atlantic Coast, Part VII, "Chesapeake Bay Entrance to Key West;" Tide Tables for the year 1896; Bulletins 31, 32, 33, and 34; and Notices to Mariners Nos. 181 to 193, inclusive.

The usual distribution was made of the annual reports of the Superintendent, the appendices to the same printed separately in pamphlet form, bulletins, and Notices to Mariners, and they were also furnished in large numbers in response to numerous special applications. The distribution of annual reports was as follows:

Date of report.	Domestic distribution.		Foreign distribution.		Total.
	To institutions.	To individuals.	To institutions.	To individuals.	
1851	2		1		3
1852	2		1		3
1853	1	1	1		3
1854	2		1		3
1855	1				1
1856	3	1			4
1857	2				2
1858	3				3
1859	4				4
1860	2				2
1861	1	1			2
1862	2				2
1863	3				3
1864	1				1
1865	1				1
1866	2				2
1867	3				3
1868	3	1			4
1869	2				2
1870	3				3
1871	2	1			3
1872	3				3
1873	8	3			11
1874	8	5			13
1875	10	1			11
1876	9	5			14
1877	10	2			12
1878	9	3			12
1879	14	12	2	1	29
1880	12	45	2	2	61
1881	12	22	2	2	38
1882	13	18	2	2	35
1883	12	22	3	2	39
1884	13	46	3	3	65
1885	12	21	3	2	38
1886	13	15	3	2	33
1887	14	20	3	2	39
1888	13	32	4	2	51
1889	13	36	3	3	55
1890	15	46	4	3	68
1891, Part 1	70	35	5		110
1891, Part 2	18	84	4	3	109
1892, Part 1	232	176	80	3	491
1892, Part 2	724	563	246	23	1 556
Total	1 302	1 217	373	55	2 947

The following is a list of the publications of the Survey, with the number of copies of each, received during the year from the Public Printer:

Name of publication.	No. of copies.
Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1892, Part I	700
Tide Tables for the Pacific Coast of America, together with stations in Asia, Australia, and islands of the Pacific Ocean, for the year 1895	5 518
Supplement to first edition United States Coast Pilot, Atlantic Coast, Parts I-II, "From the St. Croix River to Cape Ann"	500
Supplement to first edition United States Coast Pilot, Atlantic Coast, Part III, "From Cape Ann to Point Judith"	500
Supplement to second edition United States Coast Pilot, Atlantic Coast, Part IV, "From Point Judith to New York"	525
Supplement to second edition United States Coast Pilot, Atlantic Coast, Part V, "From New York to Chesapeake Bay Entrance"	400
Supplement to first edition United States Coast Pilot, Atlantic Coast, Part VI, "Chesapeake Bay and Tributaries"	525
Catalogue of Charts and other publications, 1894	2 708
H. R. Ex. Doc. No. 324, Fifty-third Congress, third session—"Expenditures Coast and Geodetic Survey, 1894"	200
Bulletin No. 31—"Legal units of electrical measure in the United States"	5 000
Bulletin No. 32—"The constant of aberration as determined from observations of latitude at San Francisco, Cal."	2 000
Bulletin No. 33—"The direction and intensity of the earth's magnetic force at San Francisco, Cal."	2 000
Bulletin No. 34—"Distribution of the magnetic declination in Alaska and adjacent waters for the year 1895"	2 000
Appendix No. 1, Report for 1893—"State laws authorizing entrance upon lands within State limits for the purposes of the United States Coast and Geodetic Survey"	300
Appendix No. 2, Report for 1893—"Heights from geodetic leveling between St. Louis and Jefferson City, Mo., 1882 and 1888"	300
Appendix No. 3, Report for 1893—"Phototopography as practiced in Italy and in the Dominion of Canada, with a brief historical review of other photographic surveys and publications on the subject"	300
Appendix No. 4, Report for 1893—"Photographic determinations of longitude by lunar distances"	300
Appendix No. 5, Report for 1893—"On the measurement of base lines with steel tapes and with steel and brass wires"	300
Appendix No. 6, Report for 1893—"Fundamental standards of length and mass"	1 000
Appendix No. 7, Report for 1893—"Units of electrical measure"	300
Appendix No. 8, Report for 1893—"A historical account of the boundary line between the States of Pennsylvania and Delaware"	500
Appendix No. 9, Report for 1893—"Proceedings of the Geodetic Conference held at Washington, D. C., January 9 to February 28, 1894"	500
Appendix No. 10, Report for 1893—"The preparation and arrangement of the exhibit of the United States Coast and Geodetic Survey at the World's Columbian Exposition, 1893"	300
NOTICES TO MARINERS.	
No. 181, June, 1894—Chart corrections during the month	9 500
No. 182, July, 1894—Chart corrections during the month	9 500
No. 183, August, 1894—Chart corrections during the month	9 500
No. 184, September, 1894—Chart corrections during the month	9 500
No. 185, October, 1894—Chart corrections during the month	9 500
No. 186, November, 1894—Chart corrections during the month	9 500
No. 187, December, 1894—Chart corrections during the month	9 500
No. 188, Index to Notice to Mariners, 1894; chart corrections	9 500
No. 189, January, 1895—Chart corrections during the month	9 500
No. 190, February, 1895—Chart corrections during the month	9 500
No. 191, March, 1895—Chart corrections during the month	9 500
No. 192, April, 1895—Chart corrections during the month	9 500
No. 193, May, 1895—Chart corrections during the month	9 500

The following-named persons were employed in the division during the year:

Freeman R. Green, clerk.
Harry J. Van Der Beek, stenographer, transferred to Treasury Department March 19, 1895.
Marie L. Fout, writer, appointed May 6, 1895.
J. A. Watts, engineer, transferred to Treasury Department August 10, 1894.
P. J. Mullen, engineer, appointed August 13, 1894.
David Parker, watchman.
John W. Drum, watchman.
J. A. McDowell, watchman.
Ed. D. Scott, messenger.
Charles Over, messenger.
Thomas McGoines, messenger.
Charles H. Jones, messenger.
John W. Miner, messenger.

Attrell Richardson, messenger.
William R. McLane, messenger.
Horace Dyer, fireman.
John H. Brown, laborer.
Baylor Crutchfield, laborer.
Boston Brown, laborer.
John H. Mason, laborer.
Sarah E. Flynn, laborer, services ceased July 15, 1894.
Virginia McGlincey, laborer, appointed July 18, 1894.
William Young, extra laborer, died October 24, 1894.
Alfred Gilbert, extra laborer, appointed November 1, 1894.
Walter Y. Clark, extra laborer, appointed May 3, 1895.

Respectfully, yours,

W. P. RAMSEY,
Chief of the Miscellaneous Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE INSTRUMENT DIVISION OF THE UNITED STATES COAST AND GEODETIC SURVEY OFFICE FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

INSTRUMENT DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the work of the instrument division for the fiscal year ending June 30, 1895:

This division has to make the needed repairs to instruments; plan and construct new instruments; determine their constants so far as it is practicable to do so at the office; purchase new instruments; send out, receive, and account for all instruments and general property used in the field and the various divisions of the office, and purchase all material needed for carrying on its work.

The force during the year has been as follows:

Edwin Smith, assistant and chief of division, July 1, 1894, to January 17, 1895.
J. F. Pratt, assistant and chief of division, January 18, 1895, to date.
William C. Maupin, clerk, entire year.
E. G. Fischer, chief instrument maker, entire year.
Otto Storm, mechanician, entire year.
Clement Jacomini, instrument maker, entire year.
Jacob Schwartz, instrument maker, July 1, 1895, to April 22, 1895.
S. A. Kearney, instrument maker, entire year.
C. E. Regennas, instrument maker, entire year.
M. Lauxmann, instrument maker, entire year.
H. O. French, carpenter, entire year.
G. W. Clarvoe, carpenter, entire year.
C. N. Darnall, carpenter, entire year.
William West, messenger, July 1, 1895, to July 31, 1895.
J. W. Hunter, messenger, August 14, 1895, to date.

By his own request, Assistant Edwin Smith was relieved from duty as chief of the division on January 17, and the undersigned was detailed to succeed him at that time.

The major part of the work in the instrument and carpenter shops is in the nature of repairs and construction, most of the new work being of special and unusual designs.

The following tables, Nos. I and II, give statistics of repairs and new work, respectively, and Table No. III, a list of instruments purchased.

TABLE I.—*Summary of instruments repaired and remodeled between July 1, 1894, and June 30, 1895.*

Instrument.	Number.	Instrument.	Number.
Alidades, plane table	24	Protractors, three-arm	12
Azimuth circles, marine	2	Ruling machine	1
Base bars	4	Sector	1
Base-bar comparators	2	Station transits	15
Binoculars	20	Sextants	27
Chronographs	3	Sextant mirrors, resilvered	186
Chronodyke	1	Steel tapes, ordinary	43
Compass declinometer	1	Telemeters, plane-table	65
Comptometers	2	Theodolites	38
Condenser connections for break-circuit chronometers	7	Tide gauges, self-registering	9
Current meter, electrical	1	Tide staff	1
Declaration of Independence—new case for original copperplate engraving and alto of same	1	Topographic camera	1
Dip circles	4	Transit, astronomical	1
Draw telescopes	6	Typewriter	1
Geodetic level	1	Vertical circle	1
Geodetic leveling rods	4	Zenith telescope	1
Gradienters	2	REPAIR WORK FOR OFFICE OF STANDARD WEIGHTS AND MEASURES.	
Heliotrope	1	Balance (for State of Rhode Island) repaired and repolished	1
Level	1	Half bushels, repolished	3
Magnetometer	1	Sets avoirdupois weights, repolished	4
Meridian telescopes	4	Yards, standard, brass, repolished	10
Pantograph	1		
Sets pendulum apparatus	3	Total number of instruments repaired and remodeled	544
Plane tables	27		

TABLE II.—*New instruments made between July 1, 1894, and June 30, 1895.*

Instrument.	Number.	Instrument.	Number.
Apparatus for measuring the magnifying power of eyepieces	1	Tripods for theodolites	9
Apparatus for saturating leveling rods with paraffin	1	Tripods for station transits	4
New sensitive drill presses for shop use	2	Tide staffs	3
File cases for different divisions of the Office	7	NEW WORK EXECUTED FOR THE OFFICE OF STANDARD WEIGHTS AND MEASURES.	
Geodetic leveling rods, saturated with paraffin	2		
Heliotrope	1	Cases, for capacity measures, of black walnut and glass	2
Micrometer eyepieces	1	Set of fixtures for determining expansion of leveling rods	1
Plane-table tops	16	Guide plate, brass, nickeled, for set of small weights	1
Plane-table stands	4		
Telemeters	25	Total number of instruments and apparatus constructed	81
Tripod, for dip circle	1		

TABLE III.—*Instruments purchased between July 1, 1894, and June 30, 1895.*

Instrument.	Number.	Instrument.	Number.
Circles, dip (Kew pattern)	3	Objective for theodolite No. 146	1
Clocks, hydrographic	37	Pens, drawing	6
Clocks for self-registering tide gauges	12	Pens, detail drawing	2
Dividers, ordinary	2	Protractors, celluloid	6
Dividers, hair-spring	6	Protractors, horn	6
Dividers, bow	2	Scale, triangular, boxwood	1
Dividers, steel spacing	3	Sextant, double reflecting	1
Eyepieces, Ramsden's	6	Specimen cups, Stellwagen	6
Floats, copper, for self-registering tide gauges	3	Thermometers	6
Lens, biconcave, for ship's azimuth compass	1	Triangles, celluloid	11
Leveling rods	2	Tripod, folding camera	1
Manometer tubes, for pendulum apparatus	8	Total number of instruments purchased	138
Objectives for microscopes	6		

One hundred and fifty requisitions have been received from field parties and the Office. The filling of many of these has required several days' work of a large portion of the working force. This work, and the repair and construction of carrying and packing cases for field instruments, is not shown in the foregoing tables.

The heating and ventilating appliances of the graduating room have been radically changed, and the room can now be kept at the desired constant high temperature with pure air, thus avoiding the danger of asphyxia so imminent heretofore.

The usual amount of work has been done for the Office in the care of clocks, electric bells, shelving in the library and archives division, making file cases, drawing boards, etc., and such general repairs about the buildings as could be done by the employees of the instrument and carpenter shops.

Eight-inch position theodolites, Nos. 130, 132, and 133, which were useless owing to obsolete construction and design, have been completely remodeled and reconstructed, and are now practically new instruments; the cones of bell metal, in red metal bearings, have been replaced by new double-cone centers of hardened steel in fine grained cast-iron bearings, and an arrangement added so that the position of the circles can be changed without moving them on their centers; the circles have been carefully regraduated, every degree being numbered so that the circle can be read through the micrometer microscopes without resorting to the use of a ten or five degree finder; the circles are protected by a light cover spun from aluminum, and very carefully constructed microscopes have been added. These instruments, although somewhat top-heavy, which is due more or less to their original design, are of a high order, and can be classed with the very best of modern instruments of their size.

Two leveling rods, supposed to be filled with paraffin, were ordered from a maker who makes a specialty of this method of filling rods, but after subjecting them to hygrometric changes, and having them compared during these changes by the office of standard weights and measures, it was found that they were not impervious to moisture, and had so large a change in length, due to that effect, that they were considered valueless for precise leveling; consequently, two new rods were made of thoroughly seasoned white pine, to be saturated with paraffin by this division. This necessitated the designing and constructing of an apparatus for saturating them with paraffin, which proved a success, as the two rods were impregnated with about 83 per cent of their weight of paraffin. These rods are virtually wooden rods, but the graduation marks, placed every 2 centimetres, are on silver-faced metallic plugs carefully inserted in the wood. They were sent to the field party early in the season, and from preliminary reports their behavior has been very satisfactory.

The zenith telescope ordered from Wanshaff of Berlin during the last fiscal year has not yet arrived.

Among the new instruments purchased are three new dip circles ("Kew" pattern) ordered from Casella of London. These instruments are being constructed to order and are not expected for two or three months.

Preliminary plans for a tide-predicting machine, in accordance with data furnished by the tidal division, showing a practical assembling of working parts, were made and approved. The construction of this machine will be commenced early in the next fiscal year, as new work can only be taken up when repairs are not pressing. It is uncertain when this machine will be completed, but probably not for about two years, as a multitude of working parts will have to be made with great accuracy.

I have to call your attention to the very poor and trying light in the instrument shop during the short days of the winter months.

The books and accounts of the division and the inventories of the field parties are in a very satisfactory condition.

A detailed account of each day's work of each employee is kept on file in the division.

It is with pleasure that I have to state that, with slight exceptions, there is a hearty and conscientious interest of the employees of the division in their respective duties.

Respectfully, yours,

J. F. PRATT,
Assistant and Chief of Instrument Division.

Mr. ANDREW BRAID,
Assistant in Charge of the Office.

REPORT OF THE LIBRARY AND ARCHIVES DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

LIBRARY AND ARCHIVES DIVISION, *June 30, 1895.*

SIR: I have the honor to submit the following report of the library and archives division, for the fiscal year ending June 30, 1895.

Mr. F. H. Parsons resigned August 20, 1894, and I was appointed chief of the division August 21, and assumed charge on that date.

LIBRARY.

The card catalogue is nearly finished; only a few Government publications and a few foreign geodetic works remain uncatalogued.

Two hundred and two volumes have been added to the library by purchase, as against 347 volumes purchased last year. No allotment of money was made to the library this year for the purchase of books, as was done in preceding years.

The library of the United States Coast and Geodetic Survey should be made the best scientific and mathematical library in this city. It contains now several valuable works, recently acquired, such as Crelle's Journal (complete set); Liouville's Journal (complete set); Mathematische Annalen (complete set); Quarterly Journal of Mathematics (complete set).

Probably the library of the Coast and Geodetic Survey is the only one in Washington containing complete sets of all the above-named important publications. I would recommend that at least $1 000 be allotted to the library for the purpose of adding some valuable works which it still needs. New mathematical and other scientific treatises bearing on the work of the Survey should be added as soon as practicable after they are issued, in order to keep this library "up to date." More good text-books of recent date are needed. I think it would be an advantage to the library if the orders for the purchase of books and for subscriptions to serials, and all correspondence relating thereto, emanated from this division.

The system of arranging and cataloguing the library adopted by my predecessor, Mr. Parsons, is incomplete and unsatisfactory as regards finding any particular book from its card in the catalogue. The shelves are not numbered; only the class number (according to the Dewey system of classification) is placed on the shelves, and that number is only placed on the first shelf at the beginning of that class. In case several shelves are occupied with the same class of books, there is nothing on the catalogue card to indicate what shelf contains the book wanted. The shelves should be numbered consecutively, and every book on a shelf should have the number of the shelf on its title page, and the same number should be entered on its card (or cards) in the catalogue; then the catalogue would tell what shelf contained any book wanted, so that anybody could find it. But to do this now would involve a large amount of time and labor, as it would be necessary to handle every book in the library and every card in the catalogue. The services of two good extra clerks would be required probably two months, perhaps longer, to number the books and enter the numbers on the cards.

The library shelves have sharp edges which injure the binding of the books, especially the heavy ones, when they are put on and taken off the shelves. I would recommend that the edges of the shelves be rounded off in order to save the books from further injury.

The services of an intelligent clerk are needed for at least two or three months in the front room of fourth story of fireproof, to finish assorting, arranging, cataloguing and filing the charts and maps therein, many of which are still in a very unsatisfactory condition as regards their accessibility.

The case that was put up while my predecessor was in charge has fixed shelves. The loose charts are injured by being shoved into place on these shelves, and I would recommend that these shelves be changed to sliding shelves, which can be drawn out and the charts removed or replaced without injury, and the shelves then shoved into place. Such shelves were put in the three cases made in the same room upon my requisition.

A case with shelves and doors has been put up in the middle room, third floor of the fireproof, in which standard Coast Survey charts, from 1880 to 1893, are filed for reference. Also, a case with drawers has been placed in the middle room of first floor of fireproof, in which standard Coast Survey charts for 1894 are filed for the same purpose.

Books purchased (volumes)	202
Books obtained by exchange, presented, and published (volumes)	465
Serials and pamphlets purchased	729
Serials and pamphlets obtained by exchange, presented and published	1 833
Maps and charts received by exchange	1 025
Books and periodicals sent to the bindery to be bound, all of which were bound and returned (volumes)	324

ARCHIVES.

Mr. E. H. Courtenay, of the computing division, was employed thirteen days in preparing and arranging original records and computations for binding, in which work he was assisted by Mr. Artemas Martin. Nothing has been done on this work since November, 1894. It should be resumed as soon as Mr. Courtenay can be spared from the computing division for that purpose.

The work of preparing original sounding records for binding had to be suspended for want of help, and it can not be resumed while the division is so short-handed.

Original tidal records of several States were prepared for binding in the tidal division, but in consequence of the loss of the help used for that purpose nothing has been done in that line for several years. This work should be taken up again as soon as possible.

Number of volumes of original records of soundings received from bindery	260
Number of volumes of original records of soundings sent to bindery	67
(All were returned bound in a substantial manner.)	
Number of volumes of original geodetic records and computations received from bindery	43
Number of volumes sent to bindery and not yet returned	76

Summary of original and duplicate records, computations, original sheets, etc., received and registered in the archives during the fiscal year:

Original observations, 549 volumes, 123 cahiers, 840 sheets, 1 package, and 90 rolls; duplicate observations, 544 volumes, 76 cahiers, and 456 sheets; field computations, 6 volumes and 146 cahiers; office computations, 7 volumes and 77 cahiers; photography, 169 negatives, 182 blue prints, 22 silver prints, 5 mounted photographs, 61 lantern slides; log books, 46 volumes; specimens of sea bottom, 33 bottles; descriptive reports, topographic sheets, 12 cahiers; descriptive reports, hydrographic sheets, 9 cahiers; topographic sheets, 29; hydrographic sheets, 26; miscellaneous, 13 volumes, 2 boxes, 6 packages, and 20 sheets.

FORCE OF THE DIVISION.

Mr. Artemas Martin was employed in the division the whole year as clerk. He had charge of registering and filing original records and sheets in the archives; of answering calls for the same and keeping account thereof; of registering books received, and answering calls for the same, and keeping account thereof; of preparing books and periodicals for binding; of preparing monthly reports; of entering records, sheets, books, etc., in the daily register and in the personal account books; which duties, with many others, he has performed in a faithful, intelligent, and satisfactory manner.

Mr. John Dale was employed the whole year as writer. He did all the typewriting, and had charge of cataloguing the books and arranging them on the shelves; of the maps and charts on fourth floor of fireproof, and answered calls for the same. Mr. Dale also assisted in clerical work, and in answering calls for books and records. He performed all his duties efficiently and faithfully, and I regret to have to state that he intends to sever his connection with the Survey in a few months. I desire here to express my hearty commendation of the valuable services of both Mr. Martin and Mr. Dale. The success with which I have been enabled to conduct this division is due in a great measure to their experience in the work, their faithfulness, efficiency, and cheerful readiness on all occasions.

Mr. John F. Renfro was appointed and assigned to this division August 21, 1894. On November 17 of the same year he was transferred to the superintendent's office.

Mr. Preston Boisseau was transferred to this division from the chart division April 29, 1895, but was transferred back to the chart division June 7, 1895.

Mr. William H. Butler was assigned to this division as messenger September 1, 1894, and was on duty the rest of the fiscal year. He has made himself particularly useful in many ways, and I desire to express my appreciation of his valuable services.

Respectfully, yours,

H. SIDNEY KING,
Chief of Library and Archives Division.

Mr. ANDREW BRAID,
Assistant in Charge of Office.

OFFICE REPORT NO. 2—1895.

REPORT OF THE HYDROGRAPHIC INSPECTOR FOR THE FISCAL YEAR 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE HYDROGRAPHIC INSPECTOR,
Washington, D. C., June 30, 1895.

SIR: I beg leave to submit the following report for the fiscal year ending June 30, 1895, of the operations of the hydrographic parties under this office, including the movements of the vessels of the Survey and the necessary repairs, and a reference to the work performed by the Hydrographic Division and Coast Pilot party. I also append report from the chief of the last-mentioned division and party, together with a tabulated synopsis of the field work and a roster of officers of the Navy who have been connected with the Survey during the fiscal year.

HYDROGRAPHY—ATLANTIC COAST.

At the beginning of the fiscal year the schooner *Eagre* and party under the charge of Lieut. William F. Low, U. S. N., Assistant, was actively engaged in finishing the special examinations in and about Boston Harbor, mention of which was made in my last annual report. The work was completed on July 25, 1894, and the party transferred to Salem, where a resurvey of the harbor and its approaches was immediately commenced.

The hydrography of Salem Harbor is of the most complicated character, and credit is due to Lieutenant Low and his party for the thoroughness with which the work was carried out. The sounding lines were run with exceeding care, and are close enough to answer all present and future requirements. The soundings on the lines of intersection cross perfectly, which is due largely to the excellent tidal data observed by the party. The plane of reference obtained from the day and night observations of one lunar month agreed when checked by the day tides of two lunar months, within 0·06 of a foot. By comparative observations it was found that high and low water occurred at Bakers Island and Salem at the same time, and that the rise and fall was also the same.

The hydrography of this survey—the first resurvey since the original work of 1850–51—differs materially, on account of the closer developments, from what we now publish on our charts, and I would suggest that it be utilized on our publications as soon as possible. The work of this party was finished on December 8, 1894.

The *Eagre* was moved to Gloucester on October 9, and the resurvey of that harbor commenced and finished October 23, when the Salem work was resumed. The hydrography of Gloucester Harbor, though not of the same complex character as that of Salem, was executed with great care, and the results are very satisfactory.

On December 8 the *Eagre* returned to the Boston Navy-Yard to refit, repair, overhaul the launches, and complete the office work. On January 14, under orders from the Navy Department, Lieutenant Low was relieved from duty on the Survey, having completed a successful tour of duty of three years and five months on this work, and ordered to duty at the Navy-Yard, Boston, Mass. I desire in this connection to express my appreciation of the work executed by Lieutenant Low on board the *Eagre*. He exhibited great skill in carrying out the details, was exact in his methods, and his records reflect credit not only upon himself and his party but upon the general service.

Lieut. C. S. Ripley, U. S. N., after the detachment of Lieutenant Low, remained in charge of the *Eagre* until February 7, when Lieut. G. C. Hanus, U. S. N., who had been detailed by the Navy Department for duty on the Survey, by your direction assumed command of the vessel.

Lieutenant Hanus has entered upon his third tour of duty on the Survey, and from his previous admirable record on this work we have reason to congratulate ourselves in obtaining an officer who carries so excellent a reputation as a hydrographer.

After extensive repairs to the *Eagre* and steam launches, in obedience to your instructions to proceed to Buzzards Bay and commence the resurvey of New Bedford Harbor and approaches, the *Eagre* sailed from Boston May 17 and arrived at New Bedford May 20. The next day the party began the resurvey by building and determining signals, establishing tide gauges, etc. On the 31st of May the party, having built and determined 58 signals and natural objects, commenced sounding with launches 22 and 23. At the end of the fiscal year 341 miles of sounding lines had been located.

Pursuant to instructions to survey the waters of the north shore of Boston Bay from Lynn to Marblehead, the steamer *Bache*, under the command of Lieut. R. G. Peck, U. S. N., Assistant, left the New York Navy-Yard on July 10, 1894, arriving at Boston the next day. After completing final preparations, work was commenced July 16 and was prosecuted until November 12, when the season was brought to a close on account of inclemency of the weather and difficulty in continuing the outside work.

Until August 21 the party was employed in special developments of the survey of 1892, including that portion of Boston Bay extending from Cohasset to Scituate, and the waters of Broad Sound. These examinations were conducted with marked success; several original discoveries of sunken rocks were made, and as they seriously affected navigation, special reports were at once made to the office.

On August 22 work was commenced on sheet No. 1, scale 1–5 000, comprising Lynn Harbor, the Saugus River, and Chelsea Creek. The ground was covered by a rectangular system of lines 80 metres apart, and this distance was reduced in the channels for the east and west lines to 40 metres. Lieutenant Peck took special pains in obtaining the plane of reference. The zero of the gauge was connected with the bench mark at the Boston Navy-Yard by careful simultaneous observations. An intermediate gauge was established at Point Shirley, but found unnecessary; connection was therefore made directly with the navy-yard. In the tide reduction for the Saugus River and Chelsea Creek, a time correction was used for every quarter-mile zone into which the working ground was divided. The results from this survey are especially gratifying, as the office has not before possessed sufficient data to publish a reliable chart of Lynn Harbor.

On September 20 sheet No. 2, scale 1–10 000, covering the coast from Nahant to Cat Island, including the harbor of Marblehead, was taken up and prosecuted until November 6, when the general development of the sheet was finished. The ground was covered by a rectangular system of lines, in general 100 metres apart for the launch work and 150 metres for the ship. In Marblehead Harbor the lines were 50 metres apart, and in the Marblehead Channel the intervals between the north and south lines were 75 metres. The special developments, of which a large number will be required, were necessarily deferred until another season. Two tide gauges were established, one at Nahant and the other at Cat Island, and both gauges were connected with the gauge established by Lieutenant Low at Salem. This survey, as far as completed, differs from the survey of 1854 on account of the more detailed character of the latter.

A special examination of Tinkers Ledge having been ordered, Lieutenant Peck made a careful investigation by sounding and dragging, and developed a least depth of 5¼ fathoms where the chart shows 6½ fathoms.

After completing some supplementary examinations of shoal spots in the approaches to Boston Harbor, the steamer *Bache* left Boston for Gloucester, N. J., November 15, and arrived at that place November 20. A new steam whaleboat was received, and the *Bache* returned to New York, arriving November 23, 1894.

The *Bache*, having prepared for work on the west coast of Florida, left New York January 9, 1895, and arrived at Pensacola February 3. Brief stops were made at Hampton Roads, Virginia, Key West, Fla.; and Punta Rasa, Fla., for the purpose of transporting the schooner *Spy* to Pensacola, Fla., and at Tampa Bay to locate the Palatine Shoal.

There existed some doubt as to the correct location of Palatine Shoal, and Lieutenant Peck was specially directed to carefully determine its position. This he accomplished in a most satis-

factory manner, proving at the same time that the former position of the shoal was based on an error in the assumed position of Mullett triangulation station. Beyond question, the original Mullett triangulation station is now to seaward of the present shore line. Besides the exceedingly careful determination of all necessary points in the prosecution of this work, the *Bache* located the quarantine station and wharves, house on north end of Anna Maria Key, pilot lookout station, Egmont Key, isolated house on south end of same key, the new beacon in north and south channels, the entrance and quarantine buoys, all of which were at once inserted in the charts affected.

For the prosecution of the hydrography of Pensacola Bay, four projections were sent to Lieutenant Peck, two of which covered East Bay, one that part of Pensacola Bay extending from the city to East Bay, and the remaining one the bar and entrance of Pensacola Bay. All of the work thus assigned was completed, with the exception of the entrance sheet, which was not begun owing to the lateness of the season. This sheet is now all that remains to complete the resurvey of Pensacola Bay and adjacent waters.

In laying out the work it was believed that the best results would be obtained by lines giving right-angled intersections, and that a distance of 175 metres would be quite close enough to insure good work, due regard being paid to the fact that in work of this character it is safer to err on the side of fullness. Particular attention was paid to the investigation and relocating of all shoal soundings handed down from former surveys. The plane of reference was obtained by two months' continuous day and night tidal observations.

The *Bache* closed work May 11, and left Pensacola the same day for Charlotte Harbor, Florida, to search for a shoal reported off the entrance by the British steamer *Beaconsfield*, to examine the bar and locate a 16-foot shoal reported in the channel, and to determine the position of Gasparilla Island light-house.

After a most thorough search the *Bache* was unable to find any trace of the shoal, and it is the commanding officer's opinion that it does not exist. The party located the light-house and fully developed Boca Grande Channel. The present depth on the bar is $3\frac{1}{4}$ fathoms. In addition to the work assigned, a number of landmarks useful to the navigator were determined.

On May 17 the steamer *Bache* continued to Key West and thence to New York, where she arrived on May 25, 1895. She is now being prepared for work on the New England coast.

In compliance with the instructions from the office, the steamer *Blake* and party, under the charge of Lieut. G. W. Mentz, U. S. N., Assistant, arrived at Hyannis, Mass., August 3, 1894, and immediately began the preliminary work for the survey of the middle part of Nantucket Sound between Hyannis and Great Point, Nantucket.

Sounding commenced on August 7, and continued during suitable weather until December 1, when the work was closed.

Lines were all run by the vessel in a general north and south direction 300 metres apart, intersected at right angles by a similar system.

Tidal observations for full lunar months were made at Hyannis and Monomoy Island, as well as comparative observations at the two points.

The *Blake* was also instructed to make special examinations for certain rocks and shoals, and to supply additional developments in various localities from Hyannis to Falmouth. This work was prosecuted at every possible opportunity, and a large part of it was finished.

The work was located in an exposed position and the party was much delayed by unfavorable conditions. As a rule the points of observation were distant, and it was rarely clear enough to reflect them readily, except during windy weather, when the sea was too rough for either ship or boat. Although every advantage was taken to carry on the work, it was not finished, and the party was obliged to close work on account of the severity of the weather.

After leaving Nantucket Sound, the *Blake* proceeded to Narragansett Bay and made an examination in the approaches to Wickford Harbor, R. I., for a rock upon which the steamer *General* struck. The rock was found and located. The light-house on the north end of Conanicut Island was also located. The *Blake* then proceeded to Philadelphia, and after receiving on board a steam launch, she returned to New York, arriving December 14.

As there was no appropriation available under which the vessel could be employed, and as it

was necessary to make some extensive repairs to her hull and machinery, it was decided to place her under repairs. At the close of the fiscal year the *Blake* was still under repairs, of which mention will be made under that head.

The steamer *Endeavor* and its party continued under the charge of Lieut. L. M. Garrett, U. S. N., Assistant.

Early in July the vessel left Baltimore for the mouth of the York River to make a survey of the reported extension of York Spit Shoal. A careful and close development of the locality failed to show any indication of a shoaling. At the same time Lieutenant Garrett determined the position of the light-houses at Tue Marshes and on Wolf Trap Spit.

From Chesapeake Bay the *Endeavor* proceeded to Buzzards Bay and located a number of rocks in the entrance to Cataumet Harbor, off Monument Beach, and off Mishaum. Ribbon Reef was also newly developed.

A shoal having been reported on the west side of Hog Island, Narragansett Bay, and additional hydrography being needed in Potters Cove, the northern part of Sakonet River, and what is known as "The Cove," the *Endeavor* was directed to carry out this work. The shoal, with 15 feet of water on it, was found, and the deficiencies named were supplied; after which the *Endeavor* proceeded to execute the principal part of her summer's work. This consisted in the determination of a large number of rocks and the development of many special features in the hydrography along the north shore of Long Island Sound from Fishers Island to Throgs Neck. This work was carried on with all possible speed and was brought to a satisfactory conclusion early in November, 1894.

While engaged in Long Island Sound, the *Endeavor* assisted in the establishment of the range signals for the naval trial course between Cornfield Point and Stratford Shoal. The red sector of the light-house on Execution Rocks was also located.

Pursuant to your instructions the *Endeavor's* party then proceeded to Delaware Bay to make a resurvey of the Breakwater anchorage. This survey, executed between November 20 and 26, shows a general shoaling of about 2 feet from the condition as shown by the survey of 1883. Lieutenant Garrett reports that the gap between the Breakwater and the ice breaker has been filled, and presents an appearance similar to the Breakwater itself, except that it is lower. It is all above the surface at low water, and only a few portions are covered at high water.

After locating the light-ships off Delaware Bay entrance, the *Endeavor* returned to Baltimore to prepare for work on the Southern coast. She left Baltimore January 12, 1895, for Charleston, S. C., to make a resurvey of Charleston Harbor and approaches. The work was begun January 24, 1895, and completed on May 11, little having been accomplished before the 1st of March, however, on account of the severe winter weather.

The work of the resurvey commenced at the point on the Ashley and Cooper rivers reached by the steamer *Bache's* survey of the preceding year, and continued seaward through the old main channel, omitting such portions as had been recently surveyed by the Corps of Engineers, U. S. A.

With the exception of some alongshore work and special development lines, for which a pulling boat was used, the entire inside work was done in the new 22-foot oil-burning launch No. 30; the outside sounding lines were of necessity located in the steamer.

The recent triangulation left little to be desired in the way of signals, and necessitated the building of very few. Through the courtesy of Captain Abbott, Corps of Engineers, U. S. A., Lieutenant Garrett had a tracing made of the unfinished topographic sheet, which covered the greater part of the desired locality. The low and marshy banks of the Cooper and Ashley rivers present such an indeterminate high-water mark that the ends of sounding lines define the shore line fully as well as any other means. "The fact is," reports Lieutenant Garrett, "that there is no high-water line. The whole extent of these banks is overflowed at high tide, and the irregular ragged line of marsh grass is the only visible line of demarkation." The city front, wharves, etc., of Charleston, on the engineer's drawing were surveyed before the heavy gales of two years ago. To bring this water front up to date as far as possible sextant positions and measurements, as well as soundings, were taken along the entire front. The shore line of Morris Island has changed very materially from the old survey, due, no doubt, to the harbor improvements.

The plane of reference used for the reduction of soundings is that obtained from a long series

of observations by the Corps of Engineers, U. S. A., from the Coast and Geodetic Survey gauge at Fort Sumter. Comparison gauges were erected at different points, and whenever it was possible the soundings were reduced directly from the gauge nearest the line. In other cases a time correction was applied, and reduction was made from the Sumter gauge.

The system of lines adopted on the inner work is that of right-angle intersection 125 metres apart. Splits were introduced where it seemed desirable, and special examinations where the chart showed shoal spots in or near any channel or fairway. The *Endeavor* made this part of the work so complete that it will be many years before another resurvey of the harbor will be necessary, if the conditions are at all stable.

The work in the old main channel was not intended for a resurvey, as that channel is continually changing, and is now practically abandoned for the jetty channel; it was simply desired to cover the ground sufficiently well to correct the charts of the locality.

Having successfully finished the work assigned, the *Endeavor* returned to Baltimore, arriving at that port May 16, 1895, and commenced to refit for the summer's work.

Hydrographic work was also executed by Assistant H. L. Marindin off the north shore of Nantucket and Marthas Vineyard, Mass.

PACIFIC COAST.

As noted in my last annual report, the steamer *Patterson*, Lieut. Commander W. I. Moore, U. S. N., Assistant commanding, arrived on the working ground on May 27, 1894, and at once began work at the north end of Chatham Strait, southeastern Alaska.

The work performed during the season of 1894 includes Chatham Strait, from Point Augusta southward to Point Samuel, west end of Kenasnoo Island, a distance of 31 miles; Tenaku Passage; Freshwater Bay, and Killisnoo Harbor. The coast on both sides of the strait is bold and rocky; the surrounding country is covered with a dense growth of pine and cedar to the high-water mark. The precipitous character of the coast made the building of signals very difficult, and the measurement of base lines by the ordinary methods almost impossible.

The work was interrupted on August 2, the *Patterson* leaving the working ground for Yakutat and Lituya bays on that day for the purpose of transporting the shore parties. During the absence of the *Patterson* the topographical party was kept in the field and continued the work until her return on August 14, on which date the season's work came to an abrupt ending on account of the necessity of transporting the parties of the Alaska boundary survey south.

The season's work includes the measurement of a primary base 1 950·567 metres long; the establishment of two latitude stations, two longitude stations, and two azimuth stations; the erection of 276 signals; 385 square miles of topography, and 320 square miles of hydrography. The results have been mapped on one sheet showing the triangulation, four sheets showing the topography, and five sheets showing the hydrography of the localities covered.

The *Patterson* returned to San Francisco September 7, 1894, where the party was engaged in office work during the winter.

On March 15, 1895, Lieut. Commander E. K. Moore, U. S. N., Assistant, relieved Lieut. Commander W. I. Moore, U. S. N., of the command of the *Patterson*, and prepared the vessel and party under his charge for the next season's work.

The *Patterson* left San Francisco on April 11, 1895, having on board the boundary party under the charge of Assistant E. F. Dickins, stopped at Tacoma, Wash., to take on board Assistant P. A. Welker and party, and proceeded to southeastern Alaska. After landing Mr. Welker and party at the head of Portland Canal, and Mr. Dickins and party at Mary Island, the vessel sailed for her working ground, Chatham Strait, arriving May 11, 1895. On her passage Lieutenant-Commander Moore made a preliminary location of Topeka Rock, north entrance of Wrangell Strait.

The work assigned the *Patterson* includes a continuation of the surveys of Chatham Strait, the eastern part of Peril Strait, Hoonyah Sound, and Kootznahoo Inlet. The survey was commenced May 13, and vigorously prosecuted to the end of the fiscal year, a large amount of work having been accomplished in spite of rather unfavorable weather, and it is hoped that with fair conditions the task assigned the *Patterson* will be successfully finished.

The present commanding officer of the *Patterson*, Lieut. Commander E. K. Moore, U. S. N.,

comes to the Survey well equipped for this work, having previously served a tour of four years on board the *McArthur*, from December 15, 1876, to November 1, 1880, and during the time made an enviable reputation in this office. With a party as well equipped and organized as that of the *Patterson* the results in the field, I am sure, will be very gratifying.

The steamer *Hassler*, under the command of Lieut. G. B. Harber, U. S. N., Assistant, was engaged after June 30, 1894, in carrying chronometer comparisons between observatories at Pyramid Harbor and Sitka, Alaska. Seven and one-half round trips were made in this service throughout the season. During and between the runs the party was employed in determining the topographical features that had been omitted on certain of our Alaska charts, and which, it was thought, might be of service to the mariner. This was accomplished in a highly satisfactory manner, and credit is due to Lieutenant Harber and his party for the care and skill exhibited in the execution of this work. At the end of the season the area covered measured 1 040 square miles, which practically completes the topography within the limits of chart 8300.

Lieutenant Harber also made numerous corrections in the Alaska Coast Pilot, and submitted notes for the correction of charts 8200 and 8300.

The *Hassler*, after giving transportation to a number of boundary parties, returned to Puget Sound in company with the *Patterson*, arriving at Tacoma, Wash., September 5, 1894.

While at Tacoma, Lieutenant Harber was instructed to make a survey off the water front of the city of Tacoma, near the scene of the landslide which occurred in November last, to determine the effect upon the bottom of the bay in that locality. The survey was commenced February 9 and ended February 23, 1895. The lines were carried offshore until the soundings indicated that the limits of that portion of the bay which has undergone a change had been reached.

By direction of the Navy Department Lieutenant Harber was relieved from duty on the Coast and Geodetic Survey on April 11, 1895, and Lieut. A. C. Almy, U. S. N., Assistant, was directed to assume charge of the *Hassler*.

Lieutenant Harber served a full tour of three years on the Survey, and I desire to testify to his ability as a commanding officer, and his zeal and intelligence as chief of party. His command was always in good condition and ready for service, and the work intrusted to his care was performed with intelligence and good judgment.

The steamer *McArthur*, Lieut. F. H. Crosby, U. S. N., Assistant commanding, was, at the close of the fiscal year 1894, actively engaged in surveying the hydrography of the coast of Washington between Grays Harbor and James Island. This stretch of coast is without exception the most difficult and dangerous on the Pacific Coast.

As stated in my report of last year, the progress of the party's work at the close of the fiscal year exceeded my highest expectations, 886 miles of sounding lines having been executed.

The month of July was, considering the locality, favorable for sounding work, and ten days could be utilized in this way. From August 1 to November 7, when the vessel sailed for San Francisco, only three other days could be made use of for that purpose. This is believed to represent the average conditions, notwithstanding that after October 7 the weather was unusually severe, and that the number of disasters to shipping was unprecedented.

The finished work of the season extends from James Island southward to Promontory Point, 1½ miles south of Raft River, and offshore to a distance ranging from 20 to 25 miles.

Between James Island and Destruction Island (which is about halfway between the above points), for an average distance from the shore of about 1½ miles, there are innumerable rocks and reefs. The shore line south of Destruction Island differs in character from that to the north in presenting a lower appearance, the bluffs being of clay or sand in lieu of rocks, while there are very few outlying dangers.

The complications and difficulties in the execution of the hydrography were many, but it is my opinion that no closer or better work has been done along the open coast of the North Pacific Ocean.

The inshore work was most thoroughly developed, so that all curves of equal depth could be drawn with certainty—including the 6, 12, and 18 foot curves—perhaps the only instance of that kind along the coast. The lines from about 12 fathoms out to 50 fathoms were run a mile apart, and from these to beyond the 100-fathom curve, 2 miles apart.

The work of the season was practically closed when, on the morning of August 18, one of the

whaleboats of the vessel, in attempting to land near Jo Creek, in order to complete the building of a signal, was capsized in the surf with most distressing loss of life. The following extracts from the report of Ensign C. P. Eaton, U. S. N., dated on board the *McArthur* at Ocosta, Grays Harbor, Washington, will convey the details of the accident:

It is my painful duty to report the death by drowning of Lieut. F. H. Crosby, Quartermaster (third class) John Freyer, and Seamen William Nehm, Alexander Smith, and Jens Gudmundsen, while attempting to land through the surf near Jo Creek, about 17 miles north of Grays Harbor, on the west coast of Washington, about 8 a. m. Saturday, August 18.

The *McArthur* anchored about a mile and a half offshore at this point Friday afternoon. That afternoon Lieutenant Crosby, the commanding officer, with nine men, landed through the surf and commenced to erect a hydrographic signal. At this time the sea was smooth, with hardly any swell. Saturday morning there was a dense fog and long swell. Lieutenant Crosby left the ship with nine men in the whaleboat at 7·20 to complete the signal. When outside the surf he directed the men to take off their shoes and heavy clothing, cast off the trailing lines of the oars, unship the rudder and steer with an oar. He cautioned them that a boat might go through the surf ninety-nine times and be capsized on the hundredth. He then cautioned them, if upset, to get hold of life-preservers or oars, dive under the breakers and come up between them to breathe, and make for the beach. They then pulled a few strokes toward the beach when a big breaker caught the boat and swung her to starboard nearly broadside to surf. Before they could turn the boat another breaker caught her and capsized her. After a hard struggle, five men—Erik Carlson, quartermaster (second class); Seamen Jan Rask, Charles Hagerstrom, and U. Becker, and First-Class Fireman O. Danielson succeeded in getting ashore, most of them in a dazed, exhausted condition. They were cared for by the settlers along the beach. As soon as sufficiently revived they and a number of settlers patrolled the beach, searching for the others. The whaleboat was washed ashore about 1 mile below where most of the survivors landed.

There are white settlers every mile or so along the beach, and both white men and Indians are constantly traveling back and forth, but the fog was so thick that morning that one could see only 40 or 50 yards, and the settlers first knew of the accident by the survivors of the whaleboat going to their houses. About 11 a. m. the fog began to clear; I had a lookout kept from the ship and watched constantly myself with the glasses for the captain and party. I saw no signs of them at work on the signal, and feared an accident had happened, especially as the surf was very heavy. I ran in as close to the shore with the ship as was safe, and after a while saw a man waving a tablecloth as a signal. Knowing that I could do nothing from outside with the ship or boats, I ran inside Grays Harbor and anchored near Damons Point. On the way down I kept a careful lookout for any signs of the party, knowing that there was a strong inshore current to the southward. I felt that nothing could be done by us under the circumstances, however, as such a long time (three hours) had elapsed since the whaleboat must have entered the surf. Immediately upon arrival at Damons Point I secured a team and drove up the beach to the scene of the disaster, and found that five men had reached the beach in safety. They patrolled the beach until 2 p. m., then returned to the ship. The settlers patrolled the beach that day until dark, and all the next day. They did all in their power to render assistance. The whaleboat, oars, etc., were washed ashore, but no bodies have been found up to this time.

I gathered the tools, gear, etc., they had ashore and engaged a wagon to bring the whaleboat down to the Oyehut where I can get it, and, knowing I could do no further good, started back for the ship. On the way down, our team ran away while crossing a bridge over swampy land, and Roscoe, the apothecary, the driver, and myself were thrown out. Roscoe had a bad hole made in front of his left leg above the ankle, reaching to the bone, and from his complaints I feared he had suffered internal injuries also. I got another team, and as soon as we got back to the ship came to Ocosta. Fortunately, the doctor says Roscoe's injuries are not serious. The hole in his leg will lay him up for several weeks, probably.

I escaped with a sprained hand and leg and bruised head, and will probably be all right in three or four days. A little steamer makes daily trips to the Oyehut from Ocosta, and the settlers along the beach will keep me informed as to whether any bodies are found. I expect to go to the Oyehut after the whaleboat in a few days, if able, or will have it and the gear brought over by the steamer. I directed that they be left in the care of the storekeeper at the Oyehut.

From the accounts of the settlers the bodies may be washed ashore in from three to ten days, or not at all.

A statement of each one of the survivors accompanies letter No. 1698 on file in this office. These statements give practically the same account of the disaster, with the addition of individual experience. The log book also gives a brief account, with a journal of the occurrences from day to day. All of the bodies except that of Seaman Smith, were recovered and interred by the crew of the *McArthur*. Over each grave was erected a cairn and suitable headboards bearing the name, rate, vessel, cause of death, and date. The location of each grave, with full details, will be found with letter No. 1873 of 1894 on file in this office.

The thanks of the office for the generous service of the people along shore, native and white, were conveyed to them by the commanding officer of the *McArthur*.

As it was a wish frequently expressed by Lieutenant Crosby, that his body should lie where life departed, and as his wife, Mrs. Julia H. H. Crosby, coincided with these views, his body was

interred where washed up by the sea, and 30 yards north of Wreck Creek, 20 yards above high-water mark, and next north to that of Seaman Gudmundsen.

The disaster to the whaleboat of the *McArthur* was the worst the Survey has suffered since the loss of Lieut. G. M. Bache, U. S. N., and ten of his crew of the brig *Washington* off Hatteras in the hurricane of September 8, 1846.

Lieutenant Crosby deserves more than a passing notice. He first entered the Survey in November, 1882, and served as executive officer of the *Blake* until March 25, 1884, when he volunteered for the Greely Relief Expedition and went to the Arctic as the executive of the *Bear*. Upon the return of the *Bear*, he was again detailed for Coast Survey service and reported on board the *Blake* October 6, 1884, and on November 28, 1884, he took command of the *Gedney* and remained in charge of that vessel until his detachment by the Navy Department, September 14, 1888. His successful career as a chief of party induced this office to again seek his services, and on June 10, 1893, he reported for duty, and on the 20th of the same month assumed command of the *McArthur* at San Francisco and continued in command of that vessel until his death. His name will always be associated with the surveys of Passamaquoddy and Cobscook bays, St. Croix River, Maine, Long Island Sound, Delaware Bay, and the coast and harbors of Louisiana, and the seacoast of Washington, where he perished in exposing himself to the danger he labored to diminish for others.

In a personal letter to me, written several months prior to his death, he spoke of the dangerous coast on which he was employed, and remarked that he would probably make most of his landings in person, particularly where there was any danger, as he considered it the duty of the commanding officer to personally conduct the most perilous work.

The circumstances surrounding his death bear witness to his value as an officer, and my words can give but feeble praise. His energy, skill, prudence, and discretion made his service particularly valuable to the Survey, and his loss is deeply deplored, not only by this office but by the naval service, of which he was an honorable member. His records speak for themselves in the archives, and I can only add that he perished in the able and faithful performance of his duties.

The names of the brave and faithful seamen who lost their lives with him will be recorded and remembered with gratitude and praise.

Lieut. James H. Sears, U. S. N., Assistant, in accordance with your instructions, assumed command of the *McArthur* September 3, 1894. He makes special acknowledgment to Ensign C. P. Eaton, U. S. N., executive officer under Lieutenant Crosby, for assistance given in the preparation of the descriptive report relating to the season's work.

The *McArthur* left Grays Harbor on November 7 for San Francisco, arriving November 11, 1894.

In accordance with instructions, Lieutenant Sears prepared the vessel and party under his charge for the resurvey of San Francisco Bay and approaches. It is desired to make a very complete resurvey of this important harbor, so it may answer all present and future requirements. The lines of soundings will be located about 125 metres apart, upon the rectangular system, with such special development of rocks, shoals, and wharf lines as may be required.

Lieutenant Sears has been engaged in the work since February 1, 1895. The projection covering the Golden Gate and Bonita Channel is practically finished; the projection covering the bay from San Francisco and Alcatraz Island to Oakland and West Berkeley is nearly finished, and the projection lying to the northward of the last-named sheet, is now well under way. The work completed by the party at this time (June 30, 1895) represents 25 square miles (geographical) in area, and 903 nautical miles of sounding lines.

During the working season, from July 1 to October 18, 1894, the party in the steamer *Gedney*, Lieut. Lucian Flynne, U. S. N., Assistant commanding, was engaged with Assistant J. J. Gilbert in the triangulation, topography, and hydrography of Washington Sound, Washington, in the vicinity of San Juan, Orcas, and Stuart islands, and in a more thorough development of the eastern part of the Strait of Juan de Fuca. As will be noted, the hydrography during the season extends over a large area, and covers in the aggregate 475 square geographical miles.

The locality of the work in the Strait of Juan de Fuca extended from Whidby Island to the westward of Port Angeles. It also included developments of Hein Bank, McArthur Bank, Smiths Island, and the bank between Partridge Bank and Middle Bank.

The floating commerce of Puget Sound passes through these waters, and Lieutenant Flynne

reports that it is now considerable and growing in importance. Steamships run regularly between Tacoma and San Francisco; Tacoma and China, also Vancouver to China; and several lines of steamers in local waters, besides numerous sailing vessels to all parts.

The hydrography of Washington Sound is new work, and it is chiefly confined to the waters of San Juan Channel, north of Turn Island, and the passages connecting this channel with the Canal de Haro. Within these limits are a number of important harbors. There is a triweekly steamer carrying mail, passengers, and freight between Seattle and the settlements on the islands of Washington Sound.

Lieutenant Flynne and his party deserve particular mention for the large amount of work accomplished and for the excellent manner in which every detail has been carried out.

Upon conclusion of the season's work, and after making certain repairs, the steamer *Gedney* and party proceeded to San Francisco to refit the vessel and prepare the party for the resurvey of that harbor. Actual hydrographic work began on March 29, 1895, and continued until the end of the fiscal year, whenever favorable conditions permitted. The general idea of this resurvey I have alluded to under the *McArthur's* work. The *Gedney*, on June 30, had closely developed 10 square geographical miles, covering that part of San Francisco Bay from Alcatraz Island to Fort Point, including Richardsons Bay and Raccoon Strait.

Assistant J. J. Gilbert, assisted by the party on board the *Hassler*, made a topographic and hydrographic survey of part of the Puget Sound Naval Station and the dock front during April and May, 1895, for the Navy Department.

Statement of hydrographic surveys executed during the fiscal year ending June 30, 1895.

Parties.		Localities.	Surveyed by—	No. of sheets.	Scale.	Number of—					Remarks.
Naval.	Civilian.					Vols.	Angles.	Soundings.	Miles.	Square miles.	
1	....	Gloucester Harbor, Massachusetts.	W. F. Low, U. S. N.	1	10 000	8	1 978	8 294	136	3	
1	....	Salem Harbor, Massachusetts	.....do	1	10 000	25	8 761	48 886	595	14	
1	....	Entrance to Boston Harbor (additional work for sheet 2146).	.....do	....	10 000	6	2 147	6 902	88	1	
2	....	Boston Bay, north shore, from Nahant to Cat Island.	R. G. Peck, U.S.N.	1	10 000	17	3 726	29 831	638		
2	....	Lynn Harbor, Massachusetts	.....do	1	5 000	11	3 361	21 519	156	41	Platted on sheets 2129, 2133, 2146.
2	....	Boston Harbor and approaches (additional work for 3 sheets).	.....do	....	10 000	13	4 305	12 111	137		
3	....	Nantucket Sound, middle part, Great Point to Hyannis.	G. W. Mentz, U. S. N.	1	40 000	11	3 063	25 795	623	58	
3	....	Approaches to Hyannis Harbor (additional work for sheet 1880).	.....do	....	20 000	11	3 214	17 450	194	15	
3	....	Wickford Harbor entrance, location of rock (additional for sheet 992).	.....do	....	10 000	1	32	112	1	....	Including locating Conanicut light-house.
....	1	North shore of Nantucket Island and Marthas Vineyard.	H. L. Marindin...	2	10 000	9	5 930	22 780	253	12	
4	....	Buzzards Bay, location of rocks..	L. M. Garrett, U. S. N.	....	20 000	2	218	537	13	....	Platted on sheets 154, 160, 1802.
4	....	Narragansett Bay, location of shoal and additional hydrography.	.....do	....	20 000	1	91	1 826	22	2	Platted on sheet 792*a*.
4	....	Along north shore of Long Island Sound, additional hydrography.	.....do	....	10 000	20	6 186	24 350	328	10	Platted on sheets 1527, 1603 *a b c*, 1637*a*, 1638*a*, 1698, 1751, 1699, 1683, 1560*a*.
4	....	Delaware Breakwater anchorage.	.....do	1	20 000	2	363	4 128	69	3	Including locating of Delaware entrance light vessels.
4	....	Search for shoal off York Spit, Chesapeake Bay.	.... do	1	20 000	1	361	1 790	60	3	Including locating of Wolf Trap and Tue Marshes light-house.
5	....	Charleston Harbor and Main Channel, South Carolina.	.....do	2	1–10 000 1–20 000	25	8 302	41 031	625	37	
6	....	Boca Grande Channel, Charlotte Harbor, Florida, examination.	R. G. Peck, U.S.N.	....	40 000	2	266	2 301	44	2	
6	....	Palatine Shoal, entrance, to Tampa Bay.	.....do	....	20 000	2	110	586	3	....	Platted on sheet 1262.
6	....	Pensacola Bay and East Bay, Florida.	.....do	3	10 000	41	11 350	82 499	1 292	55	
7	....	San Francisco Bay, California....	Lucian Flynne, U. S. N.	1	10 000	7	6 585	12 383	375	10	
8	....	San Francisco Bay and approaches, California.	J. H. Sears, U.S.N.	2	10 000	27	15 185	55 450	903	25	

Statement of hydrographic surveys executed during the fiscal year ending June 30, 1895—Continued.

Parties. Naval.	Parties. Civilian.	Localities.	Surveyed by—	No. of sheets.	Scale.	Number of— Vols.	Angles.	Soundings.	Miles.	Square miles.	Remarks.
9	....	Coast of Washington, Arch Rock, and James Island.	F. H. Crosby, U. S. N.	2	40 000	11	3 027	10 280	451	521	
10	....	East end Strait of Juan de Fuca.	Lucian Flynne, U. S. N.	2	40 000	4	3 006	1 634	571	415	
10	....	San Juan Channel and Canal de Haro.	.....do............	4	10 000	10	7 235	10 032	662	66	
...	....	Puget Sound Naval Station, hydrography in front of dry dock.	J. J. Gilbert......	1	1 000	1	126	1 203	1	....	
11	....	Part of Tacoma Harbor, Washington.	G. B. Harber, U. S. N.	1	2 500	1	361	538	13	....	
11	....	Southeastern Alaska, chart 8300..	.....do..........		....	......	....	....	....	....	411 square miles topographic reconnoissance.
12	....	Chatham Strait, north of Peril Strait, southeastern Alaska.	W. I. Moore, U. S. N.	4	Various.	3	2 322	3 796	474	163	
13	....	Chatham Strait, south of Peril Strait, southeastern Alaska.	E. K. Moore, U. S. N.	1	....	3	2 500	4 000	500	150	Estimated.
13	1	Grand total for year ending June 30, 1895.......		32	Various.	277	105 361	451 044	9 277	1 604	
14											

Naval Party No. 10 was primarily engaged in cooperating with Mr. Gilbert in the triangulation and topography of Washington Sound.

Naval Party No. 11 carried on topographic work during and between trips from Pyramid Harbor and Sitka carrying chronometers. Was also engaged in transporting United States and Canadian boundary survey parties.

Naval Parties Nos. 12 and 13 were part of the time engaged in transporting boundary survey parties.

Number of specimens of bottom, 33.

Current stations occupied by hydrographic parties, 27.

HYDROGRAPHIC DIVISION.

This division has continued in charge of Lieut. Walter McLean, U. S. N., Assistant, who has fully maintained the excellent reputation for efficiency held by this division. Under the able management of Lieutenant McLean the system of chart corrections established is in excellent working order, as attested by the high character of our chart issue.

I beg to ask your attention to the report of Lieutenant McLean, forwarded herewith, relating to the work of the division.

REPAIRS AND MAINTENANCE OF VESSELS.

ATLANTIC COAST.

The vessels of the Survey may be now classed as old, and while they have, with few exceptions, been in commission continuously, they are in fair condition, considering the limited appropriation available for repairs.

Bache.—During the summer of 1893 this vessel, as noted in my former report, received new motive power and extensive overhauling to her hull. That the money was well expended is proved by the expenditures necessary to this vessel during the year, which amounted to about $100 for repairs to water-closets, launch's cradles, and a few minor items.

The new motive power has proven very satisfactory. The propeller, however, has not sufficient pitch for thorough efficiency, and a new one will be substituted during the next year, which I believe will give the vessel greater economy.

Blake.—This vessel was extensively overhauled, but there still remains some work to be done upon her to place her in good condition. The principal repairs made are as follows:

Cutwater renewed and stem scarfed; new coal bunker bulkheads and floors; new knightheads, port forward chock rail and cathead; new boiler keelsons, and repairs to main keelson; repairs to bottom metal; copper cable for lightning conductor; repairs to injection valve, heating radiators, air ports, galley, boiler cradles, auxiliary suction pipe, condenser, distiller, reeling engine, air pump, valve chest, sea valves, indicator gear, rock shaft, anchor engine, and steam-launch shaft. There were supplied a new crank shaft and brasses, crosshead brasses, crank-pin brasses, cross-

head guide; the eccentrics were turned up, the cylinder rebored, link motion and main and cut-off valves overhauled. There were supplied a new smokestack, Worthington feed pump, Macomb strainer, copper piping, fire-room floor plates, suction and discharge for circulating pump and discharge for bilge pump; the boilers were patched, and new cradles and davits for steam launch and new funnel were supplied. Besides these a number of minor repairs were made, at a total expense of nearly $4 000. The apron of the vessel is badly decayed, and in the near future it must be replaced.

Eagre.—This vessel received quite an extensive overhauling, as very few repairs have been made for a number of years, and it became necessary to take some steps to prevent deterioration. The running rigging was almost entirely renewed and the standing rigging overhauled, a new bowsprit was supplied, and the spar deck sheathed and calked. The vessel was docked, new limber chains were rove off, and the vessel generally overhauled, at an expense for the year of nearly $3 700. This included repairing the large launches Nos. 22, 23, and 25.

Endeavor.—Repairs were made on this vessel to the amount of $880. The principal items were new crosshead, boat davits, forecastle deck, oil tanks, calking, patching metal, and minor repairs to hull, machinery, boiler, and galley.

PACIFIC COAST.

Gedney.—This vessel received during the year a new composition propeller and steel propeller shaft, a new main cylinder and piston, repairs to main valve gear, and minor repairs to boiler and engine. Other repairs were made to the heating system, steam winch, steam launch hoisting gear, deck house, water-closets, steering gear, bulwarks, and galley. The steam launch was thoroughly overhauled. The amount expended on this vessel under repairs was a little over $1 850.

McArthur.—This vessel received repairs to the amount of $3 446 during the year. She was calked and remetaled at the Fulton Iron Works at San Francisco, and partly refastened with 1 000 composition spikes. The propeller-shaft casing and stern bearing were renewed, and new piston rings and springs supplied; the spider and follower of piston of main engine were turned up; the cylinder of the circulating pump engine was rebored and new piston ring supplied; the go-ahead eccentric and strap were replaced; the main and crank shafts were lined up; new steam-launch cradle and adjusting davits were supplied, and repairs made to reversing gear, rocker shaft, air shaft and brasses, steam windlass, steering gear, and other minor repairs to hull, engine, boiler, and steam launch.

Patterson.—Nearly $3 000 were expended on this vessel for repairs generally, as follows:

The vessel was docked at the Union Iron Works and the false keel removed; the starboard bilge keel and main keel repaired; the metal was patched where necessary; a new rudder post was supplied, and the rudder trunk and steering gear repaired; the shaft was disconnected, propeller and stern bearing renewed; pitch of screw changed from 13 to 12 feet; new bronze stern bearing was supplied and secured by Tobin bronze bolts; a large part of the upper deck was repaired and the whole covered with canvas and painted; a new main topmast and six new closets were supplied. The hull, boiler, machinery, and boats were generally overhauled.

The *Cosmos* was overhauled, deck calked, keel and bilge keel repaired, and metal patched where necessary.

Hassler.—Early in February you directed me to proceed to Puget Sound and examine the *Hassler* with reference to her further usefulness on the Survey. Under date of February 15, I reported to you the history of the vessel and her condition, and upon my recommendation you requested permission from the Department to sell her. The sale was properly advertised in all the principal ports of the Pacific Coast of the United States, and sealed bids for the purchase of the *Hassler* were invited. As the highest bid received was far below the appraised value, by direction of the Department the bid was rejected, the officers detached, crew discharged, and the vessel laid up at Port Orchard in charge of a shipkeeper. All the correspondence relating to the vessel is on file in this office.

Quick.—This vessel was almost entirely rebuilt by Mr. John Hoodless, at Milton, Fla., for $2 750. The work was very well done. The vessel is now in excellent condition, and with ordinary care will be serviceable for many years.

The *Transit* was overhauled and is in good condition.

The *Spy* was towed from Punta Rasa, Fla., to Milton, Fla., where she will be overhauled during the next year.

The *Fuca* was supplied with a new boiler, and the hull and machinery placed into excellent condition.

Minor repairs were made to the *Tarry Not.*

After proper advertisement, a contract was made with William E. Woodall & Co. for rebuilding the schooner *Matchless.* At the end of the fiscal year work on that vessel was commenced.

Four oil-burning launches were purchased from Messrs. Clay & Torbensen, of Gloucester, N. J., and supplied to the *Blake*, *Bache*, *McArthur*, and *Endeavor*. These launches have given excellent satisfaction, and I feel quite sure have paid for themselves in a single season by the increased amount of work returned by the parties.

I beg to renew the recommendation made in my report last year in reference to current observations, the exploration of the Yukon, and the surveys of the Aleutian Islands. I desire to urge the necessity for asking Congress for an appropriation to build a vessel for the Aleutian Islands work. A vessel able to do this work will cost $125 000.

Mr. J. E. Roeth has satisfactorily performed clerical duties under this office.

Very respectfully,

JEFF. F. MOSER,
Lieut. Commander, U. S. N.,
Hydrographic Inspector Coast and Geodetic Survey.

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey,
Washington, D. C.

REPORT OF THE HYDROGRAPHIC DIVISION FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE HYDROGRAPHIC INSPECTOR,
Washington, D. C., July 1, 1895.

SIR: I have the honor to submit the following report of the work of the hydrographic division, under my charge, during the fiscal year ending June 30, 1895.

A few minor functions, not heretofore belonging to it, have devolved on this division during the year, but, in general, the nature and scope of its work have remained what they have been for years past, and but few changes in the method of its execution have been introduced.

Twenty-nine new original hydrographic sheets have been drawn and platted, and the results of extensive surveys have been platted on 24 old sheets. The work on these 53 original sheets has involved the study of 228 volumes of data and the platting of 77 697 angles and 361 172 soundings. Ninety reduced drawings of hydrography have been verified, revised, and corrected. The aids to navigation have been platted on, or the titles and notes, including light tables, have been supplied for 60 new charts; and 148 proofs of new issues of charts have been revised, verified, and corrected.

The work of the division has further included a vast amount of miscellaneous drafting; the investigation and disposal of constantly received information from all sources containing changes and corrections needed on the charts; the preparation of a complete set of sketches showing the progress of finished hydrographic work on the Pacific Coast, including Alaska; the preparation of schemes for new surveys and resurveys; the comparison of old and new surveys for the determination of needed special examinations; the preparation and supervision of the publication of the monthly Notices to Mariners; and a large amount of miscellaneous work, including information furnished other Departments of the Government, and private individuals. The general and routine correspondence of the division also involves a very considerable labor. For a detailed statement of the work performed by the division I beg to refer you to the monthly reports submitted during the year.

The work of the division has at all times been kept well in hand and up to date through the individual zeal and faithfulness of its employees.

The force employed in the division during the year has consisted of Messrs. W. C. Willenbucher, F. O. Donn, and F. W. Clay, draftsmen, and Mr. E. H. Wyvill, chart corrector. These gentlemen have been unremitting in their labors, and deserve every commendation.

As chief draftsman of the division, there devolves on Mr. Willenbucher very great and varied duties, all of which are performed with great promptness, accuracy, and ability. Both Mr. Donn and Mr. Clay have executed the work falling to them with most satisfactory efficiency and faithfulness. In March, 1895, room 74, occupied as a drafting room by Mr. Donn, was flooded, through the bursting of a water pipe overhead, and work then in hand so far injured as to make its reproduction necessary. Since that time Mr. Donn has been compelled to carry on his work in a very inconvenient and cramped space allotted him temporarily in the drawing division, and it has been much retarded in consequence.

I beg to renew my recommendation that the importance and variety of Mr. Wyvill's duties as draftsman and clerk in the office of the division, and the zeal and efficiency with which he performs them, justify his reclassification and advancement.

I desire to again call attention to the desirability of an arrangement whereby this division might promptly and without special request receive information concerning the progress of improvements making under the supervision of the Engineer Corps, United States Army.

Very respectfully,

WALTER MCLEAN,
Lieutenant U. S. N.,
Chief of Hydrographic Division.

Lieut. Commander JEFF. F. MOSER, U. S. N.,
Hydrographic Inspector, Coast and Geodetic Survey,
Washington, D. C.

REPORT OF THE COAST PILOT PARTY FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., June 30, 1895.

SIR: I have the honor to submit the following report of the work of the Coast Pilot party for the fiscal year ending June 30, 1895.

Under the general direction of the Superintendent, and the supervision of the hydrographic inspector, the duties of this party involve the execution of work in the field and work in the Office incidental thereto.

At the beginning of the fiscal year the party was engaged in the compilation of field data, obtained through various sources, for a Coast Pilot volume to be entitled, "United States Coast Pilot, Atlantic Coast, Part VII, from Chesapeake Bay Entrance to Key West." I can not speak too highly of the able assistance in procuring data for this volume that was rendered by the different hydrographic parties in the field, when no vessel was available for the especial purpose. The commanding officers of different revenue cutters stationed along the part of the coast covered by this volume also materially assisted in the collection of the information used in its compilation.

About November 15, 1894, the manuscript for United States Coast Pilot, Atlantic Coast, Part VII, was sent to the printer, and on April 27, 1895, the first proofs of a part of the volume were received from him. Since that date proof has been received at intervals up to June 30, 1895. At the rate the proof is being received the volume should be ready for issue about September 10, 1895.

After the manuscript for United States Coast Pilot, Part VII, had been sent to the printer, the party was engaged in the compilation of five supplements, embodying all corrections up to date, to the five Coast Pilot volumes already published, and which cover the Atlantic Coast of the United States from the St. Croix River to Cape Henry. In the preparation of these supplements data, procured by the party in the field in 1892 and 1893, was issued, together with later information procured by the party from various sources. Between November 17, 1894, and January 30, 1895, manuscript for the five supplements was sent to the printer. The first completed supplement was received from the printer on February 27, 1895, and the last on April 11, 1895.

Besides the preparation of manuscript for new Coast Pilot volumes or their supplements, and the reading of proof, the party has corrected to the date of issue Coast Pilot volumes issued from this office. This necessary and important work involves considerable labor, as the changes in aids to navigation and hydrography along the coast and in harbors are very frequent, and corrections to printed volumes accumulate very rapidly.

The routine work of the party, in keeping up to date detailed records of changes, reported dangers, hydrographic examinations, new information available, and other data which may be used in the compilation or correction of Coast Pilot volumes, is very considerable and constant.

The party was under my charge from the beginning of the fiscal year until September 22, 1894, when I was relieved by Lieut. Franklin Swift, United States Navy. Lieutenant Swift remained in charge until June 21, 1895, when he was detached from duty in the Coast and Geodetic Survey, and the charge of the party again devolved upon me.

Mr. John Ross, nautical expert of the party, has been employed the entire fiscal year in the collection of data, the compilation of manuscript, and the preparation for publication of Coast Pilot volumes and supplements. I beg to add to the testimony of my predecessors in charge of this party, my own acknowledgment of the value of Mr. Ross's services and hearty commendation of his zeal and ability.

Assisting Mr. Ross, Mr. Talbot Pulizzi, copyist, has been engaged during the fiscal year in copying manuscript and entering corrections in Coast Pilot volumes, and other routine matters necessary to the work of the party. These labors Mr. Pulizzi has performed to my entire satisfaction.

Very respectfully,

WALTER McLEAN,
Lieutenant U. S. N.,
Assistant Coast and Geodetic Survey.

Lieut. Commander JEFF. F. MOSER, U. S. N.,
Hydrographic Inspector, Coast and Geodetic Survey,
Washington, D. C.

List of naval officers attached to the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1895.

Name.	Date attached.	Date detached.	Remarks.
LIEUTENANT COMMANDERS.			
W. I. Moore	Nov. 10, 1891	Mar. 15, 1895	
Jeff. F. Moser	Mar. 24, 1893 Reattached Oct. 30, 1893		Still in service.
E. K. Moore	Jan. 18, 1895		Still in service.
LIEUTENANTS.			
Giles B. Harber	Jan. 26, 1892	Apr. 11, 1895	
W. F. Low	Aug. 1, 1891	Jan. 14, 1895	
Robert G. Peck	June 1, 1893		Still in service.
F. H. Crosby	June 20, 1893		Drowned Aug. 18, 1894.
G. W. Mentz	July 9, 1892		Still in service.
G. C. Hanus	Feb. 7, 1895		Still in service.
Lucian Flynne	June 6, 1892		Still in service.
J. A. Shearman	Jan. 8, 1894		Still in service.
James H. Sears	Mar. 31, 1894		Still in service.
Walter McLean	Aug. 21, 1893		Still in service.
W. S. Benson	Jan. 6, 1894		Still in service.
A. G. Rodgers	Nov. 15, 1894		Still in service.
A. C. Almy	Mar. 12, 1894		Still in service.
L. M. Garrett	July 3, 1893		Still in service.
LIEUTENANTS (JUNIOR GRADE).			
C. S. Ripley	May 17, 1892		Still in service.
E. H. Tillman	Jan. 4, 1895		Still in service.
R. F. Lopez	July 26, 1893		Still in service.
Franklin Swift	Sept. 22, 1894	June 21, 1895	
L. G. Clark	Sept. 15, 1891	Feb. 21, 1895	

List of naval officers attached to the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1895—Continued.

Name.	Date attached.	Date detached.	Remarks.
LIEUTENANTS (JUNIOR GRADE)—cont'd.			
Hugh Rodman	Apr. 1, 1891		Still in service.
J. J. Blandin	Oct. 21, 1893		Still in service.
Chas. P. Eaton	June 23, 1891	Nov. 19, 1894	
W. B. Hoggatt	Jan. 17, 1894		Still in service.
ENSIGNS.			
C. P. Plunkett	June 3, 1893	Dec. 13, 1894	
G. W. Kline	Apr. 26, 1892	May 28, 1895	
C. N. McCormick	Apr. 25, 1893		Still in service.
G. Tarbox	Mar. 17, 1892	Mar. 6, 1895	
W. A. Edgar	Oct. 11, 1894		Still in service.
J. W. Oman	July 13, 1891	Dec. 18, 1894	
H. K. Hines	Oct. 27, 1894		Still in service.
N. A. McCully	Nov. 26, 1894		Still in service.
W. S. Clarke	Feb. 20, 1893		Resigned Oct. 17, 1894.
Andrew F. Long	Apr. 23, 1895		Still in service.
C. Churchill	Feb. 18, 1895		Still in service.
C. M. Stone	Feb. 20, 1895		Still in service.
A. H. Davis	Jan. 7, 1895		Still in service.
F. M. Russell	Jan. 7, 1895		Still in service.
L. H. Chandler	June 18, 1893	Sept. 1, 1894	
H. K. Benham	Mar. 31, 1894		Still in service.
F. B. Bassett	June 24, 1893	Aug. 1, 1894	
PASSED ASSISTANT SURGEONS.			
C. J. Decker	Apr. 1, 1892	Sept. 26, 1894	
Charles H. T. Lowndes	Dec. 1, 1892	May 12, 1895	
George H. Barber	July 10, 1893		Still in service.
R. M. Kennedy	Sept. 26, 1894		Still in service.
ASSISTANT SURGEONS.			
J. A. Guthrie	June 1, 1892	July 2, 1894	
B. R. Ward	July 2, 1894		Still in service.
PASSED ASSISTANT PAYMASTERS.			
Livingston Hunt	May 3, 1893	Mar. 2, 1895	
John Q. Lovell	Mar. 2, 1895		Still in service.
PASSED ASSISTANT ENGINEERS.			
K. McAlpine	July 4, 1892		Still in service.
H. G. Leopold	Mar. 30, 1893	Mar. 29, 1895	
ASSISTANT ENGINEERS.			
Andrew McAllister	Jan. 18, 1894		Still in service.
W. C. Herbert	Mar. 24, 1892	Apr. 25, 1895	
Stanford E. Moses	Apr. 10, 1895		Still in service.

RECAPITULATION.

Lieutenant-commanders	3
Lieutenants	14
Lieutenants (junior grade)	9
Ensigns	17
Passed assistant surgeons	4
Assistant surgeons	2
Passed assistant paymasters	2
Passed assistant engineers	2
Assistant engineers	3
Total	56

NOTE.—From the statement immediately following, it appears that of the 56 officers above named, 36 were on duty in the Survey at the close of the fiscal year.

List of naval officers attached to the United States Coast and Geodetic Survey June 30, 1895.

COAST AND GEODETIC SURVEY OFFICE.

Lieut. Commander Jeff. F. Moser, hydrographic inspector.

Lieut. Walter McLean, chief of hydrographic division.

P. A. Paymaster John Q. Lovell, in charge of Navy pay accounts.

Steamer Bache (*Atlantic Coast*).—Lieut. Robert G. Peck, commanding; Lieut. E. H. Tillman; Ensigns H. K. Hines, A. H. Davis, and F. M. Russell; P. A. Surg. George H. Barber; Asst. Engineer Andrew McAllister.

Steamer Blake (*Atlantic Coast*).—Lieut. G. W. Mentz, commanding; Lieuts. J. A. Shearman and W. S. Benson; Ensign Andrew F. Long; Asst. Surg. B. R. Ward; P. A. Engineer K. McAlpine.

Steamer Endeavor (*Atlantic Coast*).—Lieut. L. M. Garrett, commanding; Lieut. J. J. Blandin; Ensign C. M. McCormick.

Schooner Eagre (*Atlantic Coast*).—Lieut. G. C. Hanus, commanding; Lieut. C. S. Ripley; Ensign W. A. Edgar.

Steamer Patterson (*Pacific Coast*).—Lieut. Commander E. K. Moore, commanding; Lieuts. A. G. Rodgers, R. F. Lopez, Hugh Rodman, and W. B. Hoggatt; Ensign H. K. Benham; P. A. Surg. R. M. Kennedy; Asst. Engineer Stanford E. Moses.

Steamer McArthur (*Pacific Coast*).—Lieut. James H. Sears, commanding; Ensign N. A. McCully; Ensign C. Churchill.

Steamer Gedney (*Pacific Coast*).—Lieut. Lucian Flynne, commanding; Lieut. A. C. Almy; Ensign C. M. Stone.

Names of vessels, their tonnage, etc., in the service of the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1895.

No.	Name of vessel.	Tonnage.	Complement of— Officers.	Complement of— Men.
1	Steamer Patterson	453	12	46
2	Steamer Hassler	319	10	34
3	Steamer Blake	235	10	38
4	Steamer Bache	182	10	38
5	Steamer Gedney	174	8	29
6	Steamer McArthur	130	7	30
7	Steamer Endeavor	86	7	24
8	Steamer Cosmos	25	3	7
1	Schooner Eagre	192	6	26
2	Schooner Earnest	80	5	18
3	Schooner Matchless	....	5	14
4	Schooner Quick	63	4	12
5	Schooner Transit	43	3	9
6	Schooner Spy	35	3	9

RECAPITULATION.

Steamers	8
Schooners	6
Total	14

OFFICE REPORT NO. 3—1895.

REPORT OF THE DISBURSING AGENT FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., June 30, 1895.

SIR: I have the honor to submit the following report of the disbursing office for the fiscal year ending June 30, 1895:

The aggregate of advances to chiefs of field parties during the year was $111 323·13. The total disbursements on adjusted accounts were $407 295·83. The number of vouchers, bills, etc., adjusted and paid was 15 342. Additional statistics of the work accomplished will be found on file in this office.

The annual report of expenditures of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1894, was forwarded to the Honorable Secretary of the Treasury on February 16, 1895, for transmission to Congress. The report for the fiscal year just ended is being compiled and will be ready for transmission to Congress early in the coming calendar year.

The adjustment and settlement of the accounts of this Bureau during the year have been kept, as far as circumstances would permit, nearly up to date. I would also state that all accounts audited and paid in this office have been promptly forwarded to the Auditor for the Treasury Department for his action thereon, and his promptness in settling the same, and that too without the disallowance of a single cent during the entire fiscal year, has been a source of much gratification.

In this connection permit me to say that during the last fiscal year many difficult matters involving the expenditure of money under the law have been made easy of solution by reference, under the Dockery law, to the honorable Comptroller, who, by prompt decisions, has clearly indicated the action to be taken by this office.

The force of the office for the fiscal year has been as follows: Mr. N. G. Henry, clerk and cashier; Miss Ida M. Peck, typewriter and clerk; Mrs. Jennie H. Fitch, clerk.

Respectfully, yours,

R. J. GRIFFIN, *Disbursing Agent.*

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey,
Washington, D. C.

EXPENDITURES, COAST AND GEODETIC SURVEY, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., January 1, 1896.

SIR: I have the honor to transmit herewith the report of this office, showing a correct exhibit of all expenditures for the United States Coast and Geodetic Survey, and the office of Standard Weights and Measures, for the fiscal year ending June 30, 1895, and for all preceding

years embraced within the limits of the law for making such expenditures, including all accounts rendered and paid up to the close of business on December 31, 1895.

Respectfully, yours,

R. J. GRIFFIN, *Disbursing Agent.*

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey,
Washington, D. C.

Statement of the expenditures of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1895.

[Prepared pursuant to an act approved March 3, 1853.]

SALARIES—PAY OF FIELD OFFICERS.

To whom paid.	Time employed.	Amount.
SUPERINTENDENT.		
Thomas C. Mendenhall	Two months twenty days	$1 336·89
William Ward Duffield	Nine months	4 500·00
ASSISTANTS.		
Charles A. Schott	One year	4 000·00
George Davidson	do	4 000·00
Benjamin A. Colonna	Nine months ten days	2 734·30
Andrew Braid	One year	2 709·47
Alonzo T. Mosman	do	3 000·00
William Eimbeck	do	2 973·90
Herbert G. Ogden	do	2 947·84
Otto H. Tittmann	do	2 947·84
Aug. F. Rodgers	do	2 591·24
George A. Fairfield	do	2 565·20
John W. Donn	do	2 539·16
Erasmus D. Preston	do	2 085·11
Edward Goodfellow	One month seventeen days	313·07
Charles H. Boyd	do	286·93
Frank Walley Perkins	One year	2 200·00
Frank D. Granger	do	2 200·00
John J. Gilbert	do	2 226·17
Henry L. Marindin	do	2 226·17
John F. Pratt	do	2 173·99
Cephas H. Sinclair	do	2 173·99
Edmund F. Dickins	do	2 173·99
Dallas B. Wainwright	do	2 173·99
William H. Dennis	Eleven months	1 965·58
Isaac Winston	One year	1 973·84
Richard M. Bache	do	2 026·02
William C. Hodgkins	do	1 973·84
Philip A. Welker	do	1 693·12
James B. Baylor	do	1 973·64
John E. McGrath	do	1 973·84
John A. Flemer	do	1 973·84
Will Ward Duffield	One month	164·80
Gershom Bradford	One year	1 826·17
Edwin Smith	do	1 826·17
Stehman Forney	do	1 800·00
Charles H. Van Orden	Nine months fifteen days	1 398·14
Henry L. Whiting	One year	1 704·34
John Nelson	do	1 266·98
Fremont Morse	do	1 600·00
Walter B. Fairfield	do	1 599·90
Charles T. Iardella	do	1 426·17
W. Irving Vinal	do	1 426·17
George R. Putnam	do	1 373·95
Richard E. Halter	do	1 278·20
Fred A. Young	do	1 226·02
John F. Hayford	Two months seven days	168·72
Albert L. Baldwin	Ten months	599·30

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF FIELD OFFICERS—Continued.

To whom paid.	Time employed.	Amount.
AIDS.		
John F. Hayford	Nine months twenty-three days	$975·00
Albert L. Baldwin	Two months	201·10
Samuel B. Tinsley	Three months fifteen days	209·30
Robert L. Faris	One year	751·13
Owen B. French	Eight months fifteen days	538·85
Hugh C. Denson	Five months twenty-five days	379·13
Charles C. Yates	Five months twenty-four days	376·10
Expenditures		98 748·75
Appropriation		101 956·40
Expenditures		98 748·75
Unexpended balance		3 207·65

SALARIES—PAY OF OFFICE FORCE, 1895.

To whom paid.	Time employed.	Amount.
DISBURSING AGENT.		
Robert J. Griffin	One year	$2 200·00
GENERAL OFFICE ASSISTANT.		
Marshall W. Wines	Two months	370·60
Walter P. Ramsey	Ten months	1 496·80
CHIEF OF DIVISION OF LIBRARY AND ARCHIVES.		
Francis H. Parsons	One month twenty days	249·43
H. Sidney King	Ten months eleven days	1 550·57
CLERK TO SUPERINTENDENT.		
Martin Hensel	Two months fifteen days	251·11
John F. Renfro	Five months	496·70
CLERK TO ASSISTANT IN CHARGE.		
Adelbert B. Simons	Eleven months twenty-six days	994·57
CLERKS.		
William B. Chilton	One year	1 650·00
Nicholas G. Henry	do	1 650·00
John H. Smoot	do	1 400·00
William C. Maupin	do	1 400·00
Artemas Martin	do	1 400·00
Eugene B. Wills	do	1 200·00
Freeman R. Green	do	1 200·00
Frank W. Edmonds	do	1 200·00
J. Henry Roeth	do	1 200·00
Asa G. Randall	do	1 200·00
Eugene Rhodes	Two months	168·40
Sophie Hein	One year	1 000·00
Ida M. Peck	Four months ten days	358·66
Jennie H. Fitch	Seven months twenty-three days	649·42
Alice G. Reville	Seven months twenty days	641·27
CHART CORRECTORS.		
Edward H. Wyvill	One year	1 200·00
James H. Barker	Four months	401·10
Ida M. Peck	Seven months twenty days	769·58
Henry R. Garland	One year	900.00
Archie Upperman	do	720·00
Mary Handlan	do	720·00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—**Continued.**

SALARIES—PAY OF OFFICE FORCE, 1895—Continued.

To whom paid.	Time employed.	Amount.
BUOY COLORISTS.		
Jennie H. Fitch	Four months seven days	$252·34
STENOGRAPHER.		
Harry J. Van Der Beek	Eight months nineteen days	514·00
WRITERS.		
Lily A. Mapes	One year	900·00
Virginia Harrison	....do	900·00
Kate Lawn	....do	800·00
Alice G. Reville	Four months ten days	258·21
Florence Brower	One month	60·60
John Dale	One year	720·00
Florence B. Burlingame	Five months twenty-three days	345·40
John Hobgood	....do	290·00
Deane S. Bliss	Two months four days	130·59
Mary L. Godwin	Two months three days	128·61
Marie L. Fout	One month twenty-five days	110·73
Daniel Hurley	One year	600·00
DRAFTSMEN.		
Adolph Lindenkohl	One year	2 400·00
Henry Lindenkohl	....do	2 200·00
Edwin H. Fowler	....do	2 000·00
William C. Willenbucher	....do	2 000·00
Ferdinand Westdahl	....do	1 800·00
Ernest J. Sommer	....do	1 800·00
Frank C. Donn	....do	1 800·00
David M. Hildreth	....do	1 400·00
Charles H. Deetz	....do	1 400·00
George F. Pohlers	Two months	202·20
Edmund P. Ellis	One year	1 200·00
Charles Mahon	....do	1 000·00
Paul Erichsen	....do	1 000·00
William R. Doores	....do	900·00
Francis W. Clay	....do	900·00
COMPUTERS.		
Edward H. Courtenay	One year	2 000·00
Myrick H. Doolittle	....do	2 000·00
John H. Boutelle	....do	1 600·00
Leland P. Shidy	....do	1 600·00
Frank M. Little	....do	1 532·60
Henry Farquhar	Seven months eight days	851·71
Daniel L. Hazard	One year	1 400·00
Rollin A. Harris	....do	1 267·30
Charles H. Kummel	....do	1 200·00
Harry F. Flynn	....do	1 067·20
Lilian Pike	....do	1 000·00
Jesse Pawling, jr	Three months two days	258·33
COPPERPLATE ENGRAVERS.		
William A. Thompson	One year	2 000·00
Henry M. Knight	....do	2 000·00
Theodore Wasserbach	Two months	337·00
August Peterson	Three months nineteen days	542·90
Edward J. Enthoffer	Four months eighteen days	689·64
William H. Davis	One year	1 800·00
Edward H. Sipe	....do	1 663·87
William Mackenzie	Two months eleven days	361·04
William F. Peabody	One year	1 600·00
Henry L. Thompson	....do	1 327·81
William A. Van Doren	....do	1 063·87
Alfred H. Sefton	....do	931·93

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF OFFICE FORCE, 1895—Continued.

To whom paid.	Time employed.	Amount.
COPPERPLATE ENGRAVERS—cont'd.		
George Hergesheimer	One year	$900·00
Frank G. Wurdemann	.....do	855·97
Harry R. McCabe	.....do	833·94
Gilbert F. Dawson	Two months	109·40
Peter H. Geddes	Three months twenty-three days	287·50
Rowland H. Ford	Six months twenty-one days	145·20
ELECTROTYPER AND PHOTOGRAPHER.		
Daniel C. Chapman	Six months	900·00
Louis P. Keyser	Five months	620·80
ELECTROTYPER.		
Louis P. Keyser	Seven months	527·50
ASSISTANT ELECTROTYPER AND PHOTOGRAPHER.		
Roy Thomas	Four months sixteen days	262·52
PLATE PRINTERS.		
Frank Moore	Eleven months	1 468·10
D. N. Hoover	Eleven days	48·35
Charles J. Harlow	One year	1 000·00
Richard S. Bright	.....do	1 000·00
Eberhard Fordan	.....do	1 000·00
Abraham D. Levi	Nine months	750·00
Neil Bryant	One year	1 000·00
George B. Crawford	Three months	250·00
PLATE PRINTERS' HELPERS.		
William H. Waddington	One year	700·00
Charles F. Locraft	.....do	700·00
Louis L. Williams	Eleven months thirty days	698·10
Paul Dexter	One year	700·00
Frank C. Gohre	....do	700·00
INSTRUMENT MAKERS.		
Ernest G. Fischer	One year	1 800·00
Clement Jacomini	.....do	1 200·00
William R. Whitman	.....do	1 000·00
Stephen A. Kearney	.....do	1 000·00
Clarence E. Regennas	.....do	1 000·00
Jacob Schwarz	Nine months twenty-two days	810·44
Michael Lauxmann, jr.	One year	775·02
CARPENTERS.		
Horace O. French	One year	1 267·40
George W. Clarvoe	.....do	917·88
Charles N. Darnall	.....do	700·00
ENGINEERS.		
John A. Watts	One month, nine days	108·66
P. J. Mullen	Ten months eighteen days	883·23
JANITOR.		
Walter P. Ramsey	Two months	202·20

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

SALARIES—PAY OF OFFICE FORCE, 1895—Continued.

To whom paid.	Time employed.	Amount.
WATCHMEN.		
David Parker	One year	$880·00
John W. Drum	do	880·00
FIREMEN.		
Horace Dyer	One year	630·00
William H. Butler	do	550·00
MESSENGERS.		
Edward D. Scott	One year	880·00
Charles Over	do	820·00
Charles H. Jones	do	820·00
William R. McLane	do	820·00
Vicente Denis	do	820·00
Thomas McGoines	do	820·00
J. A. Dorsey	Eleven months twenty-three days	802·17
J. W. Reed	One year	700·00
George Newman	do	700·00
William West	One month	53·90
Josef K. Hagmann	Eleven days	19·13
John W. Miner	One year	640·00
Preston Boisseau	Eleven months eight days	600·01
John W. Hunter	Eleven months eighteen days	565·24
Attrell Richardson	One year	630·00
Dennis E. White	do	550·00
LABORERS.		
John H. Brown	One year	630·00
Baylor Crutchfield	do	630·00
Hans Bowdwin	do	550·00
Boston Brown	do	550·00
Sarah E. Flynn	Fifteen days	14·88
John H. Mason	One year	365·00
Virginia McGlincey	Eleven months thirteen days	348·14
Expenditures		130 136·77
Appropriation		135 000·00
Expenditures		130 136·77
Unexpended balance		4 863·23

RECAPITULATION.

Pay of field officers	$98 748·75
Pay of office force	130 136·77
Total expenditures	228 885·52
Total sum appropriated for salaries	236 956·40
Total sum expended for salaries	228 885·52
Unexpended balance	8 070·88

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895.

ATLANTIC COAST.

To whom paid.	On what account.	Amount.
R. M. Bache	Topography	$1 482·28
C. H. Boyd	....do	730·55
John W. Donn	....do	1 846·81
J. A. Flemer	....do	77·79
Stehman Forney	....do	59·90
L. M. Garrett	Hydrography, steamer Endeavor	1 667·76
G. C. Hanus	Hydrography, schooner Eagre	1 222·94
W. C. Hodgkins	Topography	54·50
C. T. Iardella	....do	1 390·75
W. F. Low	Hydrography, schooner Eagre	972·94
Herbert G. Ogden	Topography	1 908·05
Robert G. Peck	Hydrography, steamer Bache	2 232·74
C. S. Ripley	Hydrography, schooner Eagre	92·07
O. H. Tittmann	Topography	682·11
W. Irving Vinal	....do	1 484·16
D. B. Wainwright	....do	2 183·82
S. F. Whitemarsh	Storage	40·00
Henry L. Whiting	Topography	30·70
Expenditures		18 159·87
Appropriation		17 700·00
Add 10 per cent from objects not named		470·00
Total		18 170·00
Expenditures		18 159·87
Unexpended balance		10·13

GULF COAST, ETC.

To whom paid.	On what account.		Amount.
McKinzie, Oerting & Co	Stores for schooners Quick and Transit.		$149·59
Robert G. Peck	Hydrography, steamer Bache		2 419·41
F. Walley Perkins	Triangulation		2 319·16
P. A. Welker	Topography		1 809·94
Expenditures			6 698·10
Appropriation			7 400·00
Less 25 per cent transferred to Navy travel, etc.		$370·00	
Expenditures		6 698·10	
			7 068·10
Unexpended balance			331·90

OFFSHORE WORK, ETC.

To whom paid.	On what account.	Amount.
L. M. Garrett	Hydrography, steamer Endeavor	$1 868·17
Inspector Sixth light-house district	Oil for steamer Endeavor	13·05
George W. Mentz	Hydrography, steamer Blake	2 765·05
G. B. Reynolds & Co	Coal for steamer Blake	180·00
Expenditures		4 826·27
Appropriation		5 000·00
Expenditures		4 826·27
Unexpended balance		173·73

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

PACIFIC COAST.

To whom paid.	On what account.	Amount.
F. H. Crosby	Hydrography, steamer McArthur	$452·53
E. F. Dickins	Storage	30·00
C. P. Eaton	Hydrography, steamer McArthur	251·94
Lucian Flynne	Hydrography, steamer Gedney	5 183·83
J. J. Gilbert	Combined operations	419·31
J. F. Pratt	Storage	42·00
Aug. F. Rodgers	Triangulation and topography	3 441·66
J. H. Sears	Hydrography, steamer McArthur	4 766·13
Amount disbursed		14 587·40
Railroad accounts referred for settlement		95·72
Expenditures		14 683·12
Appropriation		15 000·00
Expenditures		14 683·12
Unexpended balance		316·88

ALASKA.

To whom paid.	On what account.	Amount.
A. C. Almy	Hydrography, steamer Hassler	$427·90
Bureau of Equipment, Navy	Coal for steamer Patterson	590·96
G. B. Harber	Hydrography, steamer Hassler	1 995·67
E. K. Moore	Hydrography, steamer Patterson	1 908·39
W. I. Moore	do	4 131·95
Expenditures		9 053·97
Appropriation		8 400·00
Add 7 per cent from tides, etc		735·00
Total		9 135·00
Expenditures		9 053·97
Unexpended balance		81·03

TIDES, ETC.

To whom paid.	On what account.	Amount.
George Davidson	Sausalito and San Francisco tidal	$1 166·64
David Hamilton	Newport tidal	120·50
Henry L. Marindin	Physical hydrography	3 104·16
F. V. Moss	Washington tidal	29·03
Homer P. Ritter	Physical hydrography	1 800·00
L. P. Shidy	Washington tidal	18·16
J. G. Spaulding	Fort Hamilton tidal	1 056·69
Expenditures		7 295·18
Appropriation		10 500·00
Less 7 per cent transferred to Alaska	$735·00	
Expenditures	7 295·18	8 030·10
Unexpended balance		2 469·82

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

COAST PILOT, ETC.

To whom paid.	On what account.	Amount.
Talbot Pulizzi	Services	$900·00
John Ross	....do	1 500·00
Expenditures		2 400·00
Appropriation		2 500·00
Expenditures		2 400·00
Unexpended balance		100·00

MAGNETICS.

To whom paid.	On what account.	Amount.
James B. Baylor	Magnetics	$230·55
George Davidson	....do	13·97
J. J. Gilbert	....do	131·35
L. G. Schultz	....do	1 508·25
Stephenson's express	....do	76·31
Expenditures		1 960·43
Appropriation		2 000·00
Expenditures		1 960·43
Unexpended balance		39·57

LEVELING.

To whom paid.	On what account.	Amount.
Isaac Winston	Precise leveling	$2 470·59
Appropriation		2 500·00
Expenditures		2 470·59
Unexpended balance		29·41

STATE SURVEYS.

To whom paid.	On what account.		Amount.
E. A. Bowser	Triangulation		$1 188·68
A. H. Buchanan	....do		1 933·86
H. C. Dangberg	Care and feed of animals		308·90
Stehman Forney	Reconnaissances		2 602·00
W. C. Hodgkins	Triangulation		608·65
L. C. Persons	Storage		13·25
C. H. Sinclair	California and Nevada boundary		5 927·43
Amount disbursed			12 582·77
Railroad accounts referred for settlement			118·27
Expenditures			12 701·04
Appropriation			13 500·00
Less 5 per cent transferred to transcontinental work		$675·00	
Expenditures		12 701·04	
			13 376·04
Unexpended balance			123·96

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

GRAVITY, ETC.

To whom paid.	On what account.	Amount.
G. R. Putnam	Gravity experiments ($1 200·47) and longitudes ($279·94).	$1 480·41
C. H. Sinclair	Longitudes	532·07
Edwin Smith	do	1 090·01
Samuel Springman	Drayage	·25
Amount disbursed		3 102·94
Railroad accounts referred for settlement		66·20
Expenditures		3 168·94
Appropriation		3 500·00
Expenditures		3 168·94
Unexpended balance		331·06

TRANSCONTINENTAL WORK.

To whom paid.	On what account.	Amount.
William Eimbeck	Triangulation	$6 411·58
F. D. Granger	do	2 682·75
F. Walley Perkins	do	1 895·90
P. A. Welker	do	2 084·49
Amount disbursed		13 074·72
Railroad accounts referred for settlement		165·76
Expenditures		13 240·48
Appropriation		12 600·00
Received from F. D. Granger, repayment to credit of appropriation		10·75
Add 5 per cent from State surveys		675·00
Total		13 285·75
Expenditures		13 240·48
Unexpended balance		45·27

NAVY TRAVEL, ETC.

To whom paid.	On what account.	Amount.
A. C. Almy, U. S. N.	Mileage	$78·80
C. Churchill, U. S. N.	do	253·36
A. H. Davis, U. S. N.	do	13·20
W. A. Edgar, U. S. N.	do	28·40
J. J. Gilbert	Special survey	76·93
G. C. Hanus, U. S. N	Mileage	17·52
H. K. Hines, U. S. N.	do	28·56
J. Q. Lovell, U. S. N.	do	16·08
C. W. McCormick, U. S. N	do	15·04
N. A. McCully, U. S. N	do	269·84
E. K. Moore, U. S. N	do	292·48
Jeff. F. Moser, U. S. N	do	1 097·52
E. D. Preston	Special survey	160·75
J. C. Richards, U. S. N.	Mileage	9·35
A. G. Rogers, U. S. N.	do	257·76
F. M. Russell, U. S. N	do	13·20
James H. Sears, U. S. N.	do	14·48

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

NAVY TRAVEL, ETC.—Continued.

To whom paid.	On what account.	Amount.
F. Swift, U. S. N	Mileage	$35·60
E. H. Tillman, U. S. N	....do	27·76
Expenditures		2 706·63
Appropriation		2 500·00
Received from E. K. Moore, repayment to credit of appropriation		4·64
Add 5 per cent from Gulf Coast, etc		370·00
Total		2 874·64
Expenditures		2 706·63
Unexpended balance		168·01

OBJECTS NOT NAMED.

To whom paid.	On what account.	Amount.
John Brown	Services	$333·87
George Davidson	Astronomical observations	136·15
Charles Johnson	Services	59·68
P. Looby	Detective service	87·95
W. O. Luscombe	Storage	20·00
George Olsen	Services	504·84
J. F. Pratt	Traveling expenses	129·80
Carl F. Schiodt	Services	600·00
C. H. Van Orden	Leveling	867·06
P. A. Welker	Traveling expenses	22·75
H. L. Whiting	....do	82·20
Amount disbursed		2 844·30
Annual contribution to the International Geodetic Association		313·90
Expenditures		3 158·20
Appropriation		4 700·00
Less 10 per cent transferred to Atlantic Coast	$470·00	
Expenditures	3 158·20	
		3 628·20
Unexpended balance		1 071·80

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of the appropriations for party expenses, 1895.]

Subitems.	Amount.
Atlantic Coast	$18 159·87
Gulf Coast, etc	6 698·10
Offshore work, etc	4 826·27
Pacific Coast	14 587·40
Alaska	9 053·97
Tides, etc	7 295·18
Coast Pilot, etc	2 400·00
Magnetics	1 960·43
Leveling	2 470·59
State surveys	12 582·77
Gravity, etc	3 102·74
Transcontinental work	13 074·72

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895—Continued.

RECAPITULATION—Continued.

Subitems.	Amount.
Navy travel, etc	$2 706·63
Objects not named	2 844·30
Amount disbursed	101 762·97
Railroad accounts referred for settlement	445·95
Annual contribution to the International Geodetic Association	313·90
Total expenditures	102 522·82
Total amount appropriated for party expenses, 1895	107 800·00
Repayment by F. D. Granger to credit of transcontinental work	10·75
Repayment by E. K. Moore to credit of navy travel, etc	4·64
Total	107 815·39
Total amount expended for party expenses, 1895	102 522·82
Unexpended balance	5 292·57

CLASSIFICATION OF EXPENDITURES FOR PARTY EXPENSES, 1895.

On what account.	Amount.
Triangulation	$4 271·30
Topography	11 521·87
Hydrography	42 087·93
Transcontinental geodetic work	13 240·48
Points for State surveys	12 701·04
Coast Pilot	2 400·00
Leveling	3 337·65
Magnetics	2 048·38
Physical hydrography	1 800·00
Geographical positions	2 038·42
Tidal operations	5 495·18
Gravity experiments	1 266·67
Contribution to International Geodetic Association	313·90
Total	102 522·82

PARTY EXPENSES, 1895 AND 1896.

ALASKA.

To whom paid.	On what account.	Amount.
E. K. Moore	Hydrography, steamer Patterson	$2 354·00
Appropriation		15 000·00
Expenditures		2 354·00
Unexpended balance		12 646·00

STATE SURVEYS.

To whom paid.	On what account.	Amount.
C. H. Sinclair	California and Nevada boundary	$875·11
Appropriation		12 000·00
Expenditures		875·11
Unexpended balance		11 124·89

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

PARTY EXPENSES, 1895 AND 1896—Continued.

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of the appropriation for party expenses, 1895 and 1896.]

Subitems.	Amount.
Alaska	$2 354·00
State surveys	875·11
Expenditures	3 229·11
Total amount appropriated for party expenses, 1895 and 1896	40 000·00
Total amount expended for party expenses, 1895 and 1896	3 229·11
Unexpended balance	36 770·89

ALASKA BOUNDARY SURVEY.

[From February 1, 1895, to December 31, 1895.]

To whom paid.	On what account.	Amount.
George Davidson	Boundary survey	$111·36
E. F. Dickins	.....do	3 455·08
W. W. Duffield	Traveling expenses	35·25
John E. McGrath	Boundary survey	887·36
E. K. Moore, U. S. N.	.....do	300·00
Fremont Morse	.....do	280·56
J. F. Pratt	.....do	25·67
P. A. Welker	.....do	5 598·96
Expenditures		10 694·24
Unexpended balance on hand Feb. 1, 1895		11 343·61
Expenditures		10 694.24
Present unexpended balance		649·37

REPAIRS OF VESSELS, 1895.

To whom paid.	On what account.	Amount.
American Ship Windlass Co	Steamer Hassler	$64·00
Clay & Torbensen	Steamer McArthur	60·00
Lucian Flynne, U. S. N.	Steamer Gedney	1 853·38
L. M. Garrett, U. S. N.	Steamer Endeavor	881·36
J. J. Gilbert	Steam launch Tarry Not	17·92
G. C. Hanus, U. S. N.	Schooner Eagre	3 637·12
G. B. Harber, U. S. N.	Steamers Hassler and Fuca	774·83
John Hoodless	Schooners Quick and Transit	3 243·25
James Reilly Repair & Supply Co.	Steamer Blake	2 563·30
Journal of Commerce and Commercial Bulletin.	Advertising	10·00
W. F. Low, U. S. N.	Schooner Eagre	29·20
McKenzie, Oerting & Co.	Schooner Quick	40·23
G. W. Mentz, U. S. N.	Steamer Blake	942·72
Mercury Publishing Co.	Advertising	9·60
E. K. Moore, U. S. N.	Steamer Patterson	211·59
W. I. Moore, U. S. N.	.....do	2 757·63
New Yorker Staats Zeitung	Advertising	2·60
Robert G. Peck, U. S. N.	Steamer Bache	101·48
C. S. Ripley, U. S. N.	Schooner Eagre	1·60
James H. Sears, U. S. N.	Steamer McArthur	3 447·10
Wm. E. Woodall & Co	Schooner Matchlesss	3 700·00
Expenditures		24 348·91
Appropriation		25 000·00
Expenditures		24 348·91
Unexpended balance		651·09

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

REPAIRS OF VESSELS, 1895—Continued.

CLASSIFICATION OF EXPENDITURES FOR REPAIRS OF VESSELS.

Name of vessel.	Amount.
Steamer Bache	$101·48
Steamer Blake	3 520·82
Schooner Eagre	3 667·92
Steamer Endeavor	881·36
Steamer Fuca	746·31
Steamer Gedney	1 853·38
Steamer Hassler	92·52
Schooner Matchless	3 707·40
Steamer McArthur	3 507·10
Steamer Patterson	2 969·22
Schooner Quick	3 035·23
Steam launch Tarry Not	17·92
Schooner Transit	248·25
Total	24 348·91

PUBLISHING OBSERVATIONS, 1895.

To whom paid.	On what account.	Amount.
Gertrude Harrison	Services	$270·97
F. L. Kendrick	....do	72·58
L. G. Schultz	....do	125·00
Charles C. Yates	....do	373·54
Expenditures		842·09
Appropriation		1 000·00
Expenditures		842·09
Unexpended balance		157·91

GENERAL EXPENSES, 1895.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS.

To whom paid.	On what account.	Amount.
D. Ballauf	Instrument shop	$14·00
Robert Beall	Books	3·00
Charles Becker	Instrument and carpenter shops	10·93
Benedict & Burnham Manufacturing Co.	Instrument shop	4·55
Hugo Bilgram	Instruments	10·90
Andrew W. Boyd	Books	25·00
John A. Brashear	Instruments	25·00
Brown & Sharpe Manufacturing Co.	Instrument shop	7·20
J. H. Bunnell & Co	....do	24·10
The Calvert Co	Books	3·75
J. B. Chamberlain	Instrument shop	2·04
J. H. Chesley & Co	Carpenter shop	12·17
Church & Stephenson	....do	46·13
The Cushman Chuck Co	....do	6·00
George Davidson	Instrument shop, subscriptions, etc	25·95
Doremus & Just	Instruments	2·00
J. W. Drew & Co	Instrument shop	29·75
Alfred Ely & Co	....do	54·01
E. Morrison Paper Co	Carpenter shop	9·90
The Engineering Magazine Co	Subscriptions	3·00
George T. Ennis	Instrument shop	99·25

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS—Continued.

To whom paid.	On what account.	Amount.
Lucian Flynne	Instruments	$7·00
M. N. Forney	Subscriptions	3·00
Richard Gasch	Instrument shop	14·16
The Geological Publishing Co	Subscriptions	1·75
General Electric Co	Instrument shop	27·49
Z. D. Gilman	Instrument and carpenter shops	36·14
Henry J. Green	Instruments	27·00
W. & L. E. Gurley	.....do	60·00
H. Hoffa	Instrument shop	6·00
Jones & Laughlin, Limited	.....do	26·09
M. E. Kahler	.....do	41·75
J. Karr	Instruments	84·50
Jas. B. Lambie	Carpenter shop	10·00
Frank Libbey & Co	.....do	195·45
Melville Lindsay	.....do	6·57
W. H. Lowdermilk & Co	Subscriptions	9·50
Lutz & Bro	Instrument shop	1·00
Mackall Bros. & Flemer	Instrument and carpenter shops	41·05
McMillan & Co	Subscriptions	3·00
F. P. May & Co	Carpenter shop	68·82
McFadden & Co	Instrument shop	47·55
W. H. Mehler	.....do	66·10
Merchant & Co	.....do	16·94
Edward Miller	Subscriptions	6·00
John Milne	Books	12·50
E. K. Moore	Instrument shop	105·00
W. B. Moses & Sons	Carpenter shop	10·87
Munn & Co	Subscriptions	7·00
George F. Muth & Co	Instrument and carpenter shops	76·67
N. Murray	Subscriptions	5·00
J. B. Nalle	Instrument and carpenter shops	85·88
T. S. & J. D. Negus	Instrument shop	125·00
John C. Parker	Subscriptions	5·00
W. W. Payne	.....do	1·60
F. W. Perkins	Instruments	1·50
Charles S. Platt	Instrument shop	7·50
Charles A. Pleasants	Carpenter shop	3·80
Publishers of Science	Subscriptions	2·50
Publishers' Weekly	.....do	5·00
E. J. Pullman	Instrument shop	7·52
Rand, McNally & Co	Books	47·00
F. J. Reutlinger	Instrument shop	10·98
E. S. Ritchie & Sons	Instruments	55·00
Arthur W. Robson	Books	1·00
Aug. F. Rodgers	Instrument shop	7·00
Royce & Marean	.....do	21·49
Scheller & Stevens	.....do	17·51
Fred A. Schmidt	Instruments	100·18
L. H. Schneider's Son	Instrument and carpenter shops	94·73
Seth Thomas Clock Co	Instruments	136·80
C. G. Sloan & Co	Books	5·35
M. Silverberg & Co	Carpenter shop	8·76
Thomas W. Smith	.....do	109·08
Thomas Somerville & Sons	Instrument shop	8·45
L. S. Starrett	Carpenter shop	8·65
C. T. Starke	Instrument shop	11·86
Gustav E. Stechert	Books	88·46
Ormond Stone	.....do	2·00
M. A. Tappan	Instruments	1·50
Tice & Lynch	.....do	5·00
C. H. Townsend	Instrument shop	90·00
University of Chicago	Subscriptions	2·00
United States Naval Institute	.....do	3·50
D. B. Wainwright	Instrument shop	·65
C. W. Walker	.....do	9·00
B. Westermann & Co	Books	39·07
H. T. Whitman	Maps	25·00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS—Continued.

To whom paid.	On what account.	Amount.
John Wiley & Son	Books	$1·50
Williams & Hanks	Instrument shop	3·64
Amount disbursed		2 602·99
Appropriation		8 000·00
Received from F. V. Abbot, Corps of Engineers, in payment for one sextant furnished by this Bureau		64·00
Total		8 064·00
Expenditures		2 602·99
Unexpended balance		5 461·01

COPPER PLATES, CHART PAPER, PRINTING INK, COPPER, ZINC, AND CHEMICALS FOR ELECTROTYPING AND PHOTOGRAPHING; ENGRAVING, PRINTING, PHOTOGRAPHING, AND ELECTROTYPING SUPPLIES; EXTRA ENGRAVING AND DRAWING; PHOTOLITHOGRAPHING AND PRINTING FROM STONE AND COPPER FOR IMMEDIATE USE.

To whom paid.	On what account.	Amount.
D. Ballauf	Printing supplies	$17·30
Charles E. Barrick	Electrotyping and photographing supplies.	4·50
R. F. Bartle & Co	Extra engraving	1 363·85
Charles Becker	Printing supplies	29·74
Henry J. Brown	Electrotyping and photographing supplies.	3·50
N. Bunch	Printing supplies	45·50
Bureau Engraving and Printing	do	653·21
Clendenin Bros	Electrotyping and photographing supplies.	499·40
George Davidson	do	7·40
E. Morrison Paper Co	Printing supplies	40·20
Peter H. Geddes	Extra engraving	702·45
C. D. Gildersleeve's Son	Printing supplies	110·00
Z. D. Gilman	Electrotyping, photographing supplies, etc.	373·29
E. N. Gray & Co	Printing supplies	143·60
W. H. Harrover	Electrotyping and photographing supplies.	1·40
A. Hoen & Co	Photolithographing	29·80
H. Hoffa	Engraving supplies	16·98
J. E. Hurley	Printing supplies	3·63
Charles Eneu Johnson & Co	do	15·00
Jones & Laughlin, Limited	do	·96
Ernest Kubel	Copper plates	462·00
Melville Lindsay	Electrotyping and photographing supplies, etc.	58·59
Mackall Bros. & Flemer	do	74·15
William Mackenzie	Extra engraving	677·29
Mackey Print Paper Co	Electrotyping and photographing supplies.	35·72
F. P. May & Co	Printing supplies, etc	4·23
Robert Mayer & Co	do	23·00
William H. Mehler	do	3·75
Edwin H. Morsell	Printing supplies	3·50
David Morris	Extra engraving	600·00
George F. Muth & Co	Printing supplies, etc	52·30
J. B. Nalle	do	89·74
The Norris Peters Co	Photolithographing	231·25
Peter Adams Co	Chart paper	3 696·94
E. J. Pullman	Electrotyping and photographing supplies.	53·67

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

COPPERP LATES, CHART PAPER, PRINTING INK, COPPER, ZINC, AND CHEMICALS FOR ELECTROTYPING AND PHOTOGRAPHING; ENGRAVING, PRINTING, PHOTOGRAPHING, AND ELECTROTYPING SUPPLIES, ETC.—Continued.

To whom paid.	On what account.	Amount.
Randolph & Clowes	Copper plates	$4·06
Edgar S. Ryder	Printing supplies	15·00
Schiller & Stevens	Electrotyping and photographing supplies.	5.16
F. H. Schneider's Son	.....do	5·06
Sharp & Sons	Copper plates	11·20
The Strobridge Lithographing Co	Photolithographing	872·45
Francis Whiteley	Copper plates	885·82
Williams, Brown & Earle	Electrotyping and photographing supplies.	14·75
Williams & Hanks	Plate printing supplies	3·90
Amount disbursed		11 945·24
Appropriation		18 000·00
Expenditures		11 945·24
Unexpended balance		6 054·76

STATIONERY, TRANSPORTATION OF INSTRUMENTS AND SUPPLIES, OFFICE WAGON AND HORSES, FUEL, GAS, TELEGRAMS, ICE, AND WASHING.

To whom paid.	On what account.	Amount.
Adams Express Co	Transportation	$89·65
Herman Baumgarten	Stationery	12·40
James Connor	Office horse	31·50
George Davidson	Stationery	14·60
Annie L. Foley	Washing	139·33
George W. Knox Express Co	Transportation	15·34
Holmes & Co	Stationery	8·78
Independent Ice Co	Ice	161·82
Minnie Kelly	Washing	8·25
Library Bureau	Stationery	26·94
Lutz Bros	Office wagon and horse	14·50
McDermott Carriage Co	.....do	47·25
George F. Muth & Co	Stationery	13·65
John C. Parker	.....do	62·35
Postal Telegraph Cable Co	Telegrams	1·25
Fred. A. Schmidt	Stationery	103·54
B. F. Shaw	Office horse	240·00
Smithsonian Institution	Transportation	38·35
Stephenson's Express	.....do	8·82
Tice & Lynch	.....do	9·68
United States Express Co	.....do	56·75
Washington Gaslight Co	Gas	1 508·25
Charles Werner	Fuel	1 102·90
Western Union Telegraph Co	Telegrams	63·77
Wyckoff, Seamans & Benedict	Stationery	·20
Expenditures		3 799·87
Deposited with Treasurer United States in payment for stationery furnished by Treasury Department		494·62
		4 274·49
Appropriation		6 000·00
Expenditures		4 274·49
Unexpended balance		1 725·51

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—**Continued.**

GENERAL EXPENSES, 1895—Continued.

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE).

To whom paid.	On what account.	Amount.
George F. Muth & Co.	Contingencies	$1.20
The National Democrat	Advertising	5.10
M. Newmeyer	Contingencies	8.48
New York Soap Works	....do	12.00
John J. O'Roke	....do	6.00
William C. Peake	Repairs and contingencies	8.80
W. P. Ramsey	Traveling, office	17.00
John F. Renfro	Extra labor	548.48
The Republic	Advertising	11.28
L. H. Schneider's Son	Contingencies	4.04
Shoemaker & Busche	....do	2.18
Marshall Smith	Extra labor	5.81
Thomas W. Smith	Contingencies	15.67
Thomas Somerville & Sons	....do	6.15
Edw. S. Spear & Co.	....do	47.17
Standard Oil Co.	....do	4.32
J. C. Thompson & Co.	Advertising	5.60
The Townsend Leader Co.	....do	7.83
The Volkes Tribune	....do	8.25
John Walsh	Repairs	15.00
Washington City post-office	Contingencies	15.00
Washington News Publishing Co.	Advertising	43.08
The Washington Post Co.	....do	55.00
The Washington Sentinel	....do	27.83
Washington Times Co.	....do	8.48
Somerset R. Waters	Contingencies	10.26
Edw. J. Watts	....do	2.70
John W. Wiedo	....do	1.50
William West	....do	22.75
Jos. P. Willett	....do	5.00
Wyckoff, Seamans & Benedict	....do	207.75
William Young	Extra labor	89.00
James L. Barbour & Son	Contingencies	2.13
Charles E. Barrick	Repairs	99.00
Andrew Braid	Travel, office	8.50
The Capitol Express	Advertising	14.70
The Capitol Press	....do	5.10
Charles T. Carter & Co	Contingencies	10.80
J. H. Chesley & Co.	....do	3.18
Chesapeake and Potomac Telephone Co.	Exchange rental	100.50
Walter Y. Clark	Extra labor	96.77
Colonist Printing and Publishing Co.	Advertising	7.05
M. G. Copeland & Co.	Contingencies	28.21
Daily News Publishing Co.	Advertising	7.73
Daily Olympian Publishing Co.	....do	3.53
George Davidson	Traveling and contingent expenses	61.00
J. C. Ergood & Co.	Advertising	34.44
Evening Star Newspaper Co.	....do	9.90
The Evening Telegram	....do	7.80
The Examiner	....do	17.10
A. M. Fite	Contingencies	2.88
Frank Freeman	....do	3.50
Alfred Gilbert	Extra labor	2.40
Z. D. Gilman	Contingencies	14.04
Hanlan & Goodman	....do	8.40
James Holleran	....do	12.00
Julius Lansburgh Carpet Co.	....do	249.28
H. Sidney King	Extra labor	164.52
Lansburgh Bros.	Contingencies	65.17
Mackall Bros. & Flemer	....do	1.14
Henry McShane Manufacturing Co.	....do	14.91
W. H. Mehler	Repairs and contingencies	23.00
Edward Miller	Contingencies	6.00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

GENERAL EXPENSES, 1895—Continued.

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE)—Continued.

To whom paid.	On what account.	Amount.
John T. Mockabie	Contingencies	$5·00
Morning Herald	Advertising	56·77
Amount disbursed		2 612·76
Deposited with Treasurer United States in payment for furniture and towels furnished by Treasury Department		86·87
Expenditures		2 699·63
Appropriation		$4 500·00
Repayment from account of William Young		21·00
Total		4 521·00
Expenditures		2 699·63
Unexpended balance		1 821·37

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of appropriation for general expenses, 1895.]

Subitems.	Amount.
Instruments, instrument shop, carpenter shop, drawing division, books, maps, charts, and subscriptions	$2 602·99
Copper plates, chart paper, printing ink, copper, zinc, and chemicals for electrotyping and photographing; engraving, printing, photographing, and electrotyping supplies; extra engraving and drawing; photolithographing and printing from stone and copper for immediate use	11 945·24
Stationery, transportation of instruments and supplies, office wagon and horses, fuel, gas, telegrams, ice, and washing	3 779·87
Miscellaneous expenses, contingencies of all kinds, office furniture, repairs, extra labor, and traveling expenses (office)	2 612·76
Total disbursements	20 940·86
Deposited in payment for stationery, furniture, etc., furnished by the Treasury Department	581·49
Total expenditures	21 522·35
Total amount appropriated for general expenses, 1895	36 500·00
Received from F. B. Abbot, Corps of Engineers, in payment for sextant	64·00
Repayment from account of William Young	21·00
Total	36 585·00
Total amount expended for general expenses, 1895	21 522.35
Unexpended balance	15 062·65

CLASSIFICATION OF EXPENDITURES FOR GENERAL EXPENSES, 1895.

On what account.	Amount.	On what account.	Amount.
Instruments	$516·38	Transportation of instruments and supplies	$233·19
Instrument shop	1 093·26	Office wagon and horse	333·25
Carpenter shop	681·87	Fuel	1 102·90
Books, maps, and charts	253·63	Gas	1 508·25
Subscriptions	57·85	Telegrams	65·02
Copper plates	1 363·08	Ice	161·82
Chart paper	3 696·94	Washing	147·58
Engraving, printing, photographing, and electrotyping supplies	2 408·13	Miscellaneous expenses and contingencies of all kinds	1 235·88
Extra engraving	3 343·59	Extra labor	1 144·58
Photolithographing and printing from stone and copper for immediate use	1 133·50	Repairs	145·80
Stationery	227·86	Traveling expenses (office)	86·50
		Total	20 940·86

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—**Continued.**

SALARIES—STANDARD WEIGHTS AND MEASURES, 1895.

To whom paid.	Time employed.	Amount.
ADJUSTER.		
Louis A. Fischer	One year	$1 500·00
MECHANICIAN.		
Otto Storm	One year	1 250·00
ASSISTANT MESSENGER.		
Charles A. Harbaugh	Eleven months nineteen days	696·52
WATCHMAN.		
J. A. McDowell	One year	720·00
Expenditures		4 166·52
Appropriation		4 190·00
Expenditures		4 166·52
Unexpended balance		23·48

CONTINGENT EXPENSES—STANDARD WEIGHTS AND MEASURES, 1895.

MATERIALS, APPARATUS, AND INCIDENTAL EXPENSES.

To whom paid.	On what account.	Amount.
Eimer & Amend	Apparatus and supplies	$271·53
Z. D. Gilman	Supplies	6·40
Henry J. Green	Apparatus and supplies	139·65
H. Hoffa	Supplies	·70
Mackall Bros. & Flemer	do	11·20
W. H. Mehler	do	1·00
George F. Muth & Co	do	13·65
J. B. Nalle	do	9·75
John C. Parker	do	2·50
Sylv. A. Schmidt, jr., & Co.	do	·42
Henry Troemner	do	3·00
United States Mint (Philadelphia)	do	4·37
John W. Weide	do	2·75
Expenditures		466·92
Appropriation		500·00
Expenditures		466·92
Unexpended balance		33·08

EXPENSES AMERICAN MEMBER INTERNATIONAL COMMITTEE.

To whom paid.	On what account.	Amount.
B. A. Gould	Traveling expenses	$475·00
Appropriation		475·00
Expenditures		475·00

Statement of the expenditures of the United States Coast and Geodetic Survey, etc.—Continued.

CONTINGENT EXPENSES—STANDARD WEIGHTS AND MEASURES, 1895—Continued.

RECAPITULATION.

[Showing expenditures in gross by subitems on account of the appropriation for contingent expenses, Standard Weights and Measures, 1895.]

Subitems.	Amount.
Materials and apparatus and incidental expenses	$466·92
Expenses American member International Committee	475·00
Total expenditures	941·92
Total amount appropriated	975·00
Total amount expended	941·92
Unexpended balance	33·08

GENERAL RECAPITULATION.

[Showing appropriations, expenditures, and balances for the fiscal year ending June 30, 1895; also unexpended balances on Alaska boundary survey, and amounts received from other Government bureaus.]

Name of appropriation.	Appropriated.	Expended.	Balances.
Salaries:			
Pay of field officers	$101 956·40	$98 748·75	$3 207·65
Pay of office force	135 000·00	130 136·77	4 863·23
Party expenses:			
Sundry civil act of August 18, 1894 $107 800·00; Repayment from F. D. Granger 10·75; Repayment from E. K. Moore 4·64	107 815·39	102 522·82	5 292·57
Alaskan boundary survey—balance from last report	11 343·61	10 694·24	649·37
Repairs of vessels	25 000·00	24 348·91	651·09
Publishing observations	1 000·00	842·09	157·91
Party expenses, 1895 and 1896	40 000·00	3 229·11	36 770·89
General expenses:			
Sundry civil act of August 18, 1894 $36 500·00; Received from F. V. Abbot 64·00; Repayment from account of William Young 21·00	36 585·00	21 522·35	15 062·65
Salaries—Weights and measures	4 190·00	4 166·52	23·48
Contingent expenses—Weights and measures	975·00	941·92	33·08
Total	463 865·40	397 153·48	66 711·92

Appropriations and expenses.		Amount.
Amounts appropriated and available as follows:		
Appropriation for Coast and Geodetic Survey proper for fiscal year ending June 30, 1895, sundry civil act, August 18, 1894		$447 256·40
Appropriations for Office of Standard Weights and Measures, legislative act, July 21, 1894		5 165·00
Balance from last report on account of Alaskan boundary survey		11 343·61
Repayment from F. D. Granger on account of party expenses		10·75
Repayment from E. K. Moore on account of party expenses		4·64
Repayment from F. V. Abbot on account of general expenses		64·00
Repayment from account William Young		21·00
		463 865·40
Amount expended as follows:		
For Coast and Geodetic Survey	$381 350·80	
For Office of Standard Weights and Measures	5 108·44	
For Alaskan boundary survey	10 694·24	
		397 153·48
Total unexpended balance		66 711·92

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1894.

PARTY EXPENSES, 1894.

PACIFIC COAST.

Subitems.	Amount.
Balance on hand, report for 1894	$1 189·09
Railroad accounts referred for settlement	86·89
Present unexpended balance	1 102·20

ALASKA.

Balance on hand, report for 1894	$157·59
Railroad accounts referred for settlement	3·97
Present unexpended balance	153·62

TRANSCONTINENTAL WORK.

To whom paid.	On what account.	Amount.
William Eimbeck	Triangulation	$5·00
Expenditures		5·00
Balance on hand, report for 1894		219·83
Expended since, as above		5·00
Present unexpended balance		214·83

OBJECTS NOT NAMED.

Subitems.	Amount.
Balance on hand, report for 1894	$904·84
Annual contribution to International Geodetic Association	313·90
Present unexpended balance	590·94

RECAPITULATION.

[Showing expenditures in gross by subitems.]

Subitems.	Amount.
Transcontinental work	$5·00
Railroad accounts referred for settlement	90·86
Annual contribution to International Geodetic Association	313·90
Expenditures	409·76
Balance on hand, report for 1894	7 373·37
Expended since last annual report, as above	409·76
Present unexpended balance	6 963·61

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1894—Continued.

GENERAL EXPENSES, 1894.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS.

To whom paid.	On what account.	Amount.
W. H. Lowdermilk & Co.	Subscriptions	$9·75
Edward P. North	Books	10·00
J. L. Shaw	do	18·00
American Institute of Electrical Engineers.	do	45·50
Publishers of Science	Subscriptions	2·60
Expenditures		85·85
Balance on hand, report for 1894		269·90
Expended since, as above		85.85
Present unexpended balance		184·05

COPPER PLATES, CHART PAPER, ETC.

To whom paid.	On what account.	Amount.
Evans & Bartle	Extra engraving	$1 090·00
Expenditures		1 090·00
Balance on hand, report for 1894		1 860·16
Expended since, as above		1 090·00
Present unexpended balance		770·16

STATIONERY, TRANSPORTATION OF INSTRUMENTS, ETC.

To whom paid.	On what account.	Amount.
Samuel Springman	Transportation	$0·50
Expenditures		·50
Balance on hand, report for 1894		136·46
Expended since, as above		·50
Present unexpended balance		135·96

RECAPITULATION.

[Showing expenditures in gross, by subitems, on account of the appropriation for general expenses, 1894.]

Subitems.	Amount.
Instruments, instrument shop, etc.	$85·85
Copper plates, chart paper, etc.	1 090·00
Stationery, transportation of instruments, etc.	·50
Total expenditures	1 176·35
Balance on hand, report for 1894	2 311·27
Expended since, as above	1 176·35
Present unexpended balance	1 134·92

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1894—Continued.

CONTINGENT EXPENSES, STANDARD WEIGHTS AND MEASURES, 1894.

MATERIALS AND APPARATUS AND INCIDENTAL EXPENSES.

To whom paid.	On what account.	Amount.
Arthur Burkhardt	Reckoning machine	$122·33
Expenditures		122·33
Balance on hand, report for 1894		624·68
Expended since, as above		122·33
Present unexpended balance		502·35

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., January 1, 1896.

I certify that the foregoing statement is a correct exhibit of all expenditures for the United States Coast and Geodetic Survey, and for the Office of Standard Weights and Measures, for the fiscal year ending June 30, 1895, and for all preceding years embraced within the limits of the law for making such expenditures, including all accounts rendered up to the close of business on December 31, 1895.

R. J. GRIFFIN,
Disbursing Agent, United States Coast and Geodetic Survey.

Approved:
W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey.

OFFICE REPORT NO. 4—1895.

REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES FOR THE FISCAL YEAR ENDING JUNE 30, 1895.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF STANDARD WEIGHTS AND MEASURES,
Washington, D. C., June 30, 1895.

SIR: I have the honor to transmit the annual report on the conduct of the Office of Standard Weights and Measures for the fiscal year ending June 30, 1895.

During my absence in the field, from the beginning of the year until September 10, the Office was in charge of Mr. L. A. Fischer, adjuster, and from September 10 to the end of the year, it was in my charge.

The regular force of the Office remained the same, and consisted of Mr. L. A. Fischer, adjuster, and Charles A. Harbaugh, assistant messenger. In addition to this force, however, Mr. John F. Hayford, Assistant, was detailed for duty on September 8, 1894, where he remained until June 14, 1895, when he was granted leave of absence until June 30, his resignation having been tendered to take effect on that date. Mr. Hayford's resignation was tendered in order that he might accept a position as instructor at Cornell University. While in the Office Mr. Hayford determined the densities and masses of the new X set of gramme weights; made a redetermination of the errors of the foot graduation of the United States bench standard, and investigated the behavior of the balance of precision recently acquired by this Office. The peculiar value of this balance arises partly from the high grade of workmanship upon it, but largely from two special auxiliary devices which enable the observer not only to note the oscillations of the beam from a distance, but also to interchange the weights upon the scale pans without approaching the balance. The balance was in January, 1895, mounted on a brick pier in an old coal vault in the southern part of the Butler Building. This, while not suitable for the purpose on account of the dampness, is the only place available, and the result of the investigation made by Mr. Hayford shows that the Office is now in a position to make weighings of the highest precision, the probable error of a single weighing with a load of 1 kilogramme being ± 0.0236 milligramme. A report on the balance has been prepared by Mr. Hayford for publication.

It gives me great pleasure to report that the laborious and tedious preparation of the State sets of weights and measures for North and South Dakota was finally completed, and they were forwarded to their destination in June. All the work of adjustment and verification of these standards devolved upon Mr. Fischer. He also gilded and adjusted the X set of gramme weights, and made four groups of direct comparisons between the Committee Metre and Prototype No. 21, with a view to settling their relation. While the results secured are remarkably accordant, it was deemed advisable to make some observations by a method which did not depend upon viewing a point, or thread, and its reflection, in the ends of the Committee Metre, and accordingly two auxiliary abutting pieces were made, and will be used as soon as the current work of the Office will permit.

Mr. C. A. Harbaugh's duties are of a miscellaneous character, and are performed with ability and dispatch. He compared alcoholometers, etched inscriptions on tapes, indexed records, and by his expeditious use of the typewriter assisted me in preparing copy of the United States Coast and Geodetic Survey Report for 1894, for the printer.

STANDARDS OF MASS.

The X set of gramme weights were made of Muntz metal, in the instrument shop of the United States Coast and Geodetic Survey, from drawings furnished by this Office. They are cylindrical in form, surmounted with knobs for handling. In order to show the uniformity in

density which may be expected where weights are made of commercially rolled metal of this composition, the densities and masses of the set are given as follows:

Densities and masses of the X set of metric weights.

Designation.	Density at 0°.0 C.	Masses.	
		Grammes.	Milligrammes.
(10 000 gm.)x	8·4079	10 000	−12·99 ±0·80
(5 000 gm.)x	8·4118	5 000	+ 2·34 ±0·60
(2 000 gm.)1x	8·4214	2 000	+ 0·24 ±0·14
(2 000 gm.)2x	8·4207	2 000	− 0·39 ±0·08
(1 000 gm.)x	8·4108	1 000	− 0·69 ±0·01
(500 gm.)x	8·4083	500	− 0·050 ±0·038
(200 gm.)1x	8·4374	200	+ 0·186 ±0·016
(200 gm.)2x	8·4328	200	+ 0·298 ±0·016
(100 gm.)x	8·4338	100	− 0·064 ±0·009
(50 gm.)x	8·443	50	+ 0·067 ±0·010
(20 gm.)1x	8·464	20	0·000 ±0·004
(20 gm.)2x	8·462	20	+ 0·068 ±0·004
(10 gm.)x	8·460	10	− 0·027 ±0·004
(5 gm.)x	8·445	5	+ 0·0260 ±0·0032
(2 gm.)1x	8·379	2	+ 0·0287 ±0·0022
(2 gm.)2x	8·319	2	+ 0·0116 ±0·0022
(1 gm.)x	8·410	1	+ 0·0092 ±0·0021

In anticipation of being called upon to make tests of electric standards, an effort was made to provide the Office with suitable standards, in accord with specifications adopted by the National Academy of Sciences, but beyond purchasing the necessary cells and material, nothing could be done, owing to the smalluess of the force and the demands upon the Office.

Yours, respectfully,

O. H. Tittmann,
Assistant, Coast and Geodetic Survey, in Charge of Office of Standard Weights and Measures.

Gen. W. W. Duffield,
Superintendent United States Coast and Geodetic Survey, and of Office of Standard Weights and Measures.

Abstract of verifications of weights and measures made during the fiscal year 1895.

Date.	Name.	Service.
1894.		
July	Woodward, Prof. R. S., Montclair, N. J	Tape compared.
	Foss, Wm. E., Brighton, Mass	Two tapes compared.
	Troemner, Henry, Philadelphia, Pa	Information furnished.
	Fauth & Co., Washington, D. C	Two tapes compared.
	Blake, Prof. Eli, Brown University	Metre bar compared.
	Coblentz, Dr. V., Ocean Grove, N. J	Information furnished.
August	State of Rhode Island	Weights and balance readjusted.
	Baltimore Topographical Survey, Baltimore, Md.	Two tapes compared.
September	Preston, E. D., Assistant U. S. C. & G. S	Tape compared.
	Stixrud & Nasten, Seattle, Wash	Tape compared.
	Roe, J. N., Valparaiso, Ind	Information furnished.
	Internal Revenue Bureau	Ullage table prepared.
	Taylor, S. S., Cairo, Ill	Two tapes compared.
	Internal Revenue Bureau	One hundred and twenty alcoholometers compared.
October	Gibson, W. F., Tilton, N. H	Information furnished.
	State sealer weights and measures, Iowa	Information furnished.
	Darling, C. P., Huntington, N. Y	Information furnished.
	Eimer & Amend, New York	Quartz plate compared.

Abstract of verifications of weights and measures made during the fiscal year 1895—Continued.

Date.	Name.	Service.
1894.		
October	Crew, Prof. H., Evanston, Ill	Information furnished.
	Krause, Albert, Buffalo, N. Y	Tape compared.
	Thies, C. F., Hoboken, N. J	Quartz plate compared.
	Harrington, Son & Co., Philadelphia, Pa	Information furnished.
	Harrington, C. L., New York	Information furnished.
	Saegmuller, G. N., Washington, D. C	Tape compared.
	U. S. Coast and Geodetic Survey	Five thermometers compared.
November	U. S. Coast and Geodetic Survey	Tape compared.
	Trautwine, J. C., Philadelphia, Pa	Information furnished.
	National Brewing Company, Baltimore, Md	Three saccharometers compared.
	Eimer & Amend, New York	Quartz plate compared.
	Kuhnemann, Emil, Brooklyn, N. Y	Quartz plate compared.
	Bodenstab, Henry, Stapleton, N. Y	Quartz plate compared.
	North Dakota Agricultural College	Information furnished.
	Murrey, W. E., Des Moines, Iowa	Information furnished.
December	Engineer Commissioner, D. C	Tape compared.
	U. S. Geological Survey	Tape compared.
	Case School of Applied Science, Cleveland, Ohio.	Kilogramme compared.
	Elgin Smelting Co., The, Leadville, Colo	Fourteen weights compared.
1895.		
January	Greeley, Frederick, Chicago, Ill	Information furnished.
	Denison & Perfler, Columbus, Ohio	Tape compared.
	French & Bryant, Brookline, Mass	Tape compared.
	Eakins, L. G., Pueblo, Colo	Information furnished.
	Towne, P. A., Edmeston, N. Y	Information furnished.
	Baldwin, Prof. Ward, Cincinnati, Ohio	Tape compared.
	Superior Scale Works, Council Bluffs, Iowa	Weights compared.
February	McCowell, John, Caldwell, Tex	Information furnished.
	Joseph, Antonio, Washington, D. C	Information furnished.
	Denver Fire Clay Co., Denver, Colo	Weights compared.
	Pueblo Smelting and Refining Co., Pueblo, Colo.	Information furnished.
	Howe Scale Co., Rutland, Vt	Information furnished.
	Case School of Applied Science, Cleveland, Ohio.	Kilogramme compared.
	Case School of Applied Science, Cleveland, Ohio.	Metre compared.
March	Baldwin, Prof. Ward, Cincinnati, Ohio	Tape compared.
	Whitney, Prof. N. O., University of Wisconsin	Thermometers compared.
	Harkness, Prof. Wm., Washington, D. C	Tape compared.
	Governor of Kentucky	Information furnished.
	Buff & Berger, Boston, Mass	Two tapes compared.
	Smith, Chas. H., Middletown, N. Y	Tape compared.
	Department Public Works, Buffalo, N. Y	Tape compared.
	Pueblo Smelting and Refining Co., Pueblo, Colo.	Weight compared.
	Denison & Perfler, Columbus, Ohio	Tape compared.
	Whitney, Prof. N. O., University of Wisconsin	Tape compared.
	U. S. Geological Survey	Two tapes compared.
	Whitaker, E. H., La Salle, Ill	Tape compared.
	Internal Revenue Bureau	Ullage table furnished.
April	Goodwin Metre Company, Philadelphia, Pa	Cubic-foot bottle compared.
	Darling, C. P., Huntington, N. Y.	
	Seelig & Kandler, Chicago, Ill	Information furnished.
	City of Newark, N. J	Weights and measures adjusted.
	U. S. Geological Survey	Tape compared.
	Rose, Hon. A. J., Austin, Tex	Information furnished.
May	Baker, E. B., Gloversville, N. Y	Two tapes compared.
	Buff & Berger, Boston, Mass	Information furnished.
	Treasury Department	Information furnished.
	Mendenhall, T. C., Worcester, Mass	Information furnished.
	Denison & Perfler, Columbus, Ohio	Information furnished.
	Treasury Department	Information furnished.
	U. S. S. Gen. Geo. W. Snow, Salt Lake City	Information furnished.
	Lutz, H. R., Guttenberg, N. Y	Information furnished.
	Denison & Perfler, Columbus, Ohio	Three tapes compared.
June	Mendenhall, T. C., Worcester, Mass	Tape compared.
	U. S. Weights and Measurès Association, San Francisco.	Weights compared.
	Osborn, W. B., Clarksburg, W. Va	Information furnished.
	U. S. Internal Revenue Bureau	Alcoholometer compared.

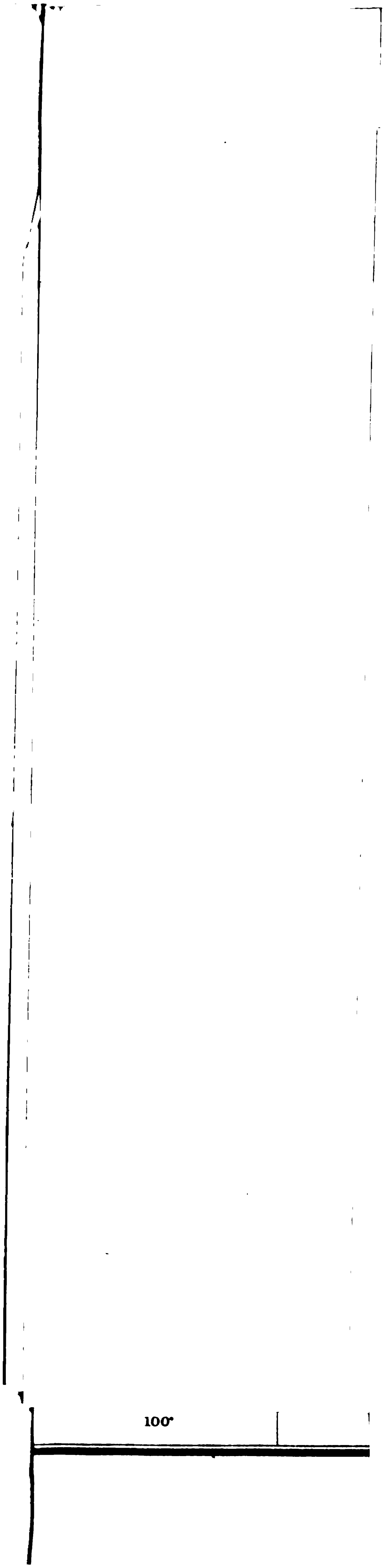
U. S. COAST AND GEODETIC SURVEY REPORT FOR 1895.

PART I.

PROGRESS SKETCHES.

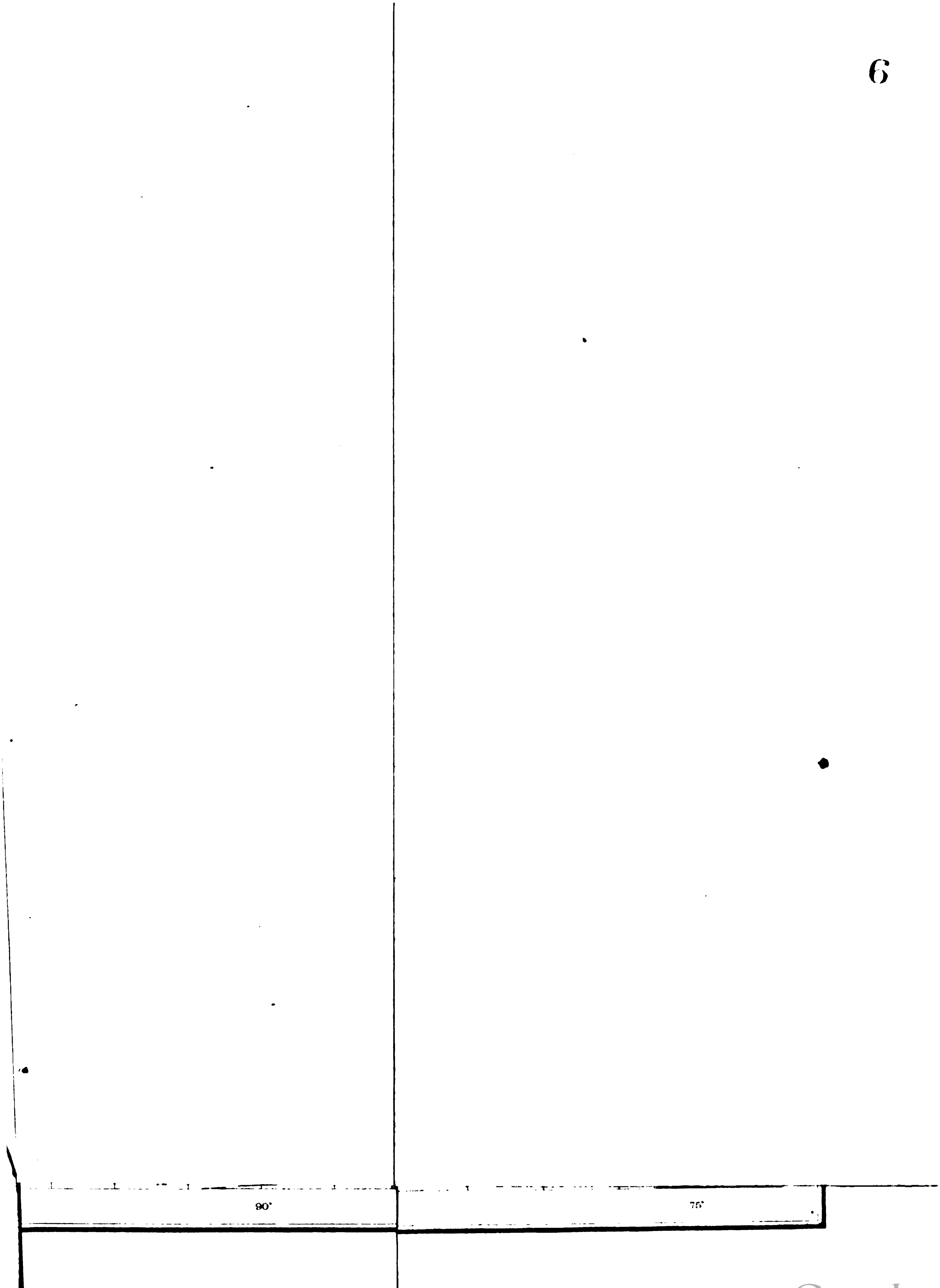
1. Sketch of general progress (eastern sheet).
2. Sketch of general progress (western sheet).
3. General chart of Alaska.
4. Progress of surveys for locating the boundary line between Alaska and the British Possessions in North America.
5. Map showing longitude stations and connections determined by the electric telegraph between 1846 and June 30, 1895.
6. Map showing positions of magnetic stations occupied between 1844 and June 30, 1895.
7. Map showing lines of geodetic leveling run, and positions of gravity stations to June 30, 1895.
8. Progress of surveys and resurveys between the St. Croix and Hudson rivers, with subsketch showing the surveys of the Northeast boundary lakes.
9. Triangulation between the Atlantic Coast and West Virginia, with subsketch showing progress of surveys near Charleston, S. C.
10. Triangulation between western Kansas and eastern Utah along or near the thirty-ninth parallel.
11. Boundary survey between California and Nevada; scale 1-400 000.
12. Progress of the surveys on the coasts of Oregon and Washington from Tillamook Bay to the boundary, with subsketch of progress in San Francisco Bay.
13. Sketch showing the extension of triangulation from Atlantic Base to the Gulf of Mexico, with subsketch showing triangulation in eastern Tennessee.
14. Progress of surveys and resurveys of the Gulf coasts of Florida and Alabama.
15. Reconnaissance for triangulation along Rio Grande, from El Paso to the Gulf of Mexico.
16. Map showing the distribution of the principal astronomic stations occupied by the Coast and Geodetic Survey for latitude, longitude, and azimuth to June 30, 1895.
17. Sketch of Porcupine River, from the boundary to Fort Yukon, Alaska; scale 1-400 000. From a reconnaissance by J. H. Turner, Subassistant in 1890.
18. Progress sketch of vicinity of St. Michaels, Alaska; scale 1-200 000. From surveys in 1890 and 1891.
19. Progress sketch of vicinity of Yakutat Bay and Mount St. Elias, Alaska; scale 1-400 000. From surveys in 1892 and 1894.
20. Progress sketch of Lituya Bay and Fairweather mountains, Alaska; scale 1-200 000. From surveys in 1894.
21. Progress sketch of Chilkat and Chilkoot rivers, Alaska; scale 1-200 000. From surveys in 1890 and 1894.
22. Progress sketch of Taku River, Alaska; scale 1-200 000. From surveys in 1890 and 1893.
23. Progress sketch of Stikine River, Alaska; scale 1-200 000. From surveys in 1886 and 1893.
24. Progress sketch of Yukon River and Fortymile Creek, at the crossing of the one hundred and forty-first meridian; scale 1-200 000. From surveys in 1889 and 1891.

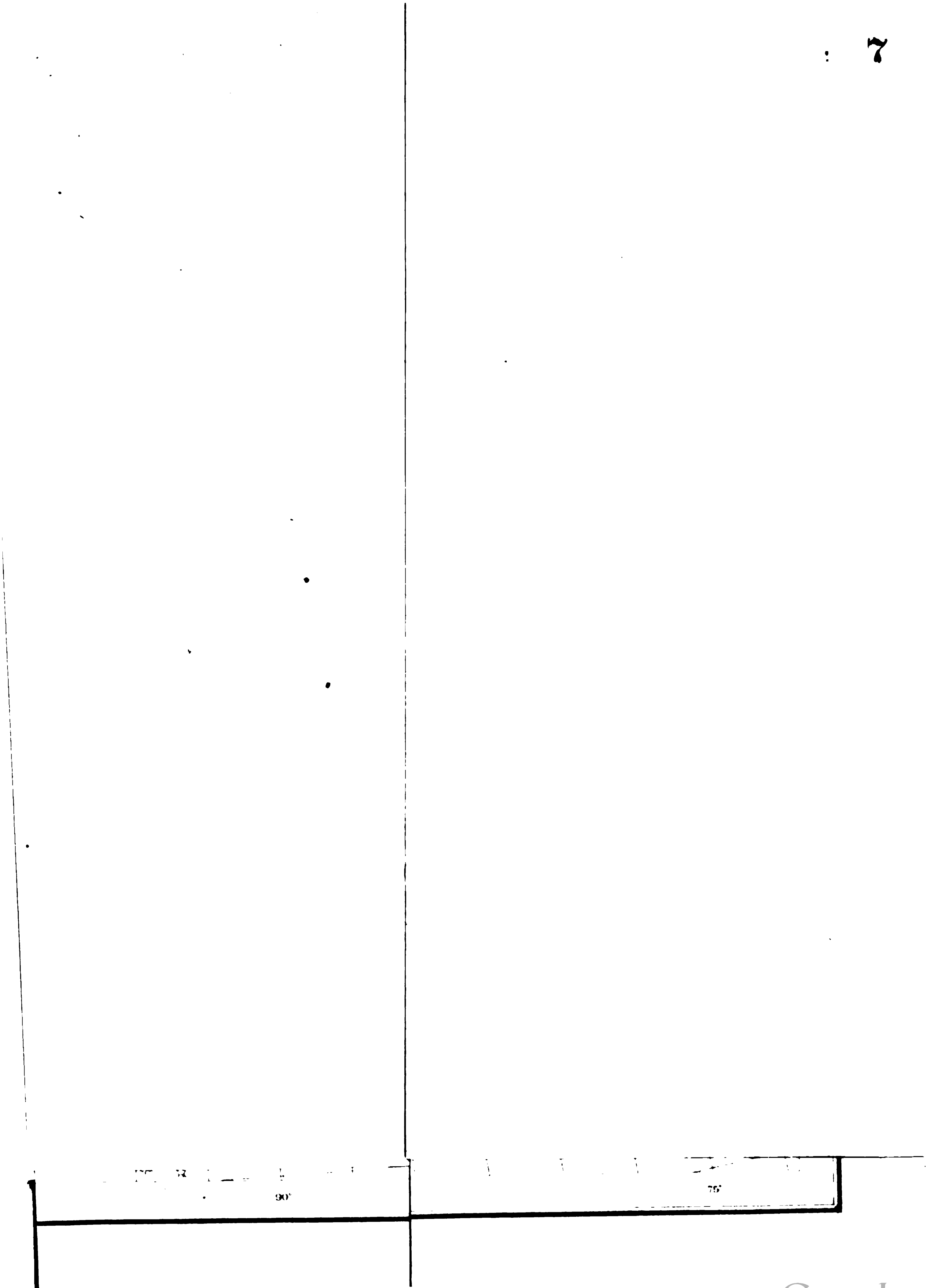
2



(*Alaska*) U. S. C. & G. S. **T**

5


90°
75°


90°
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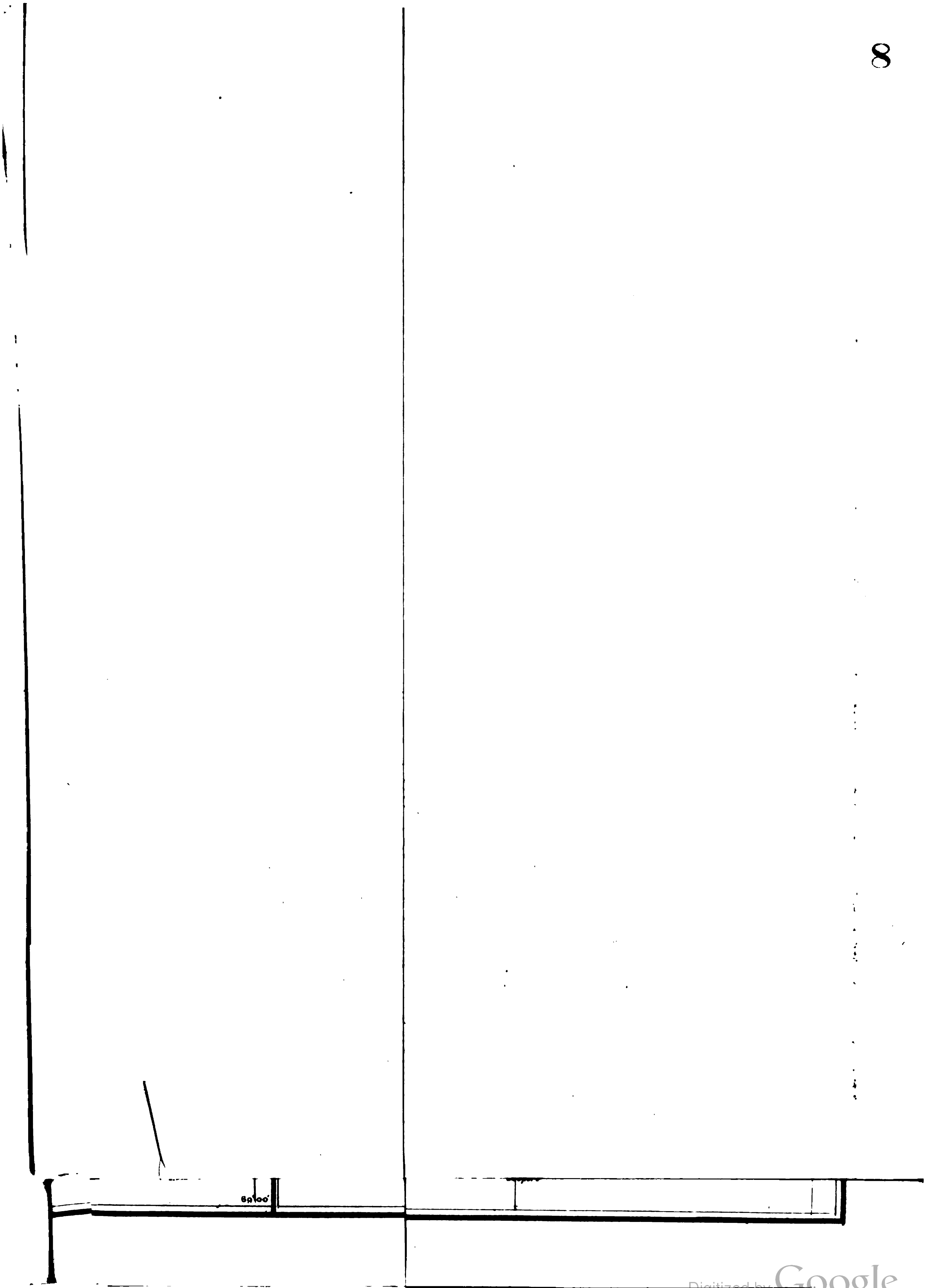
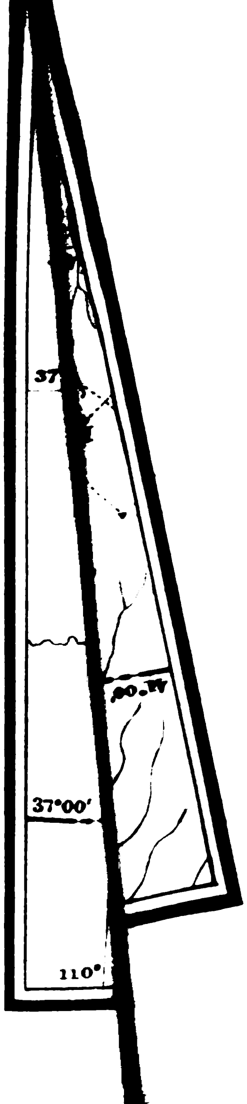
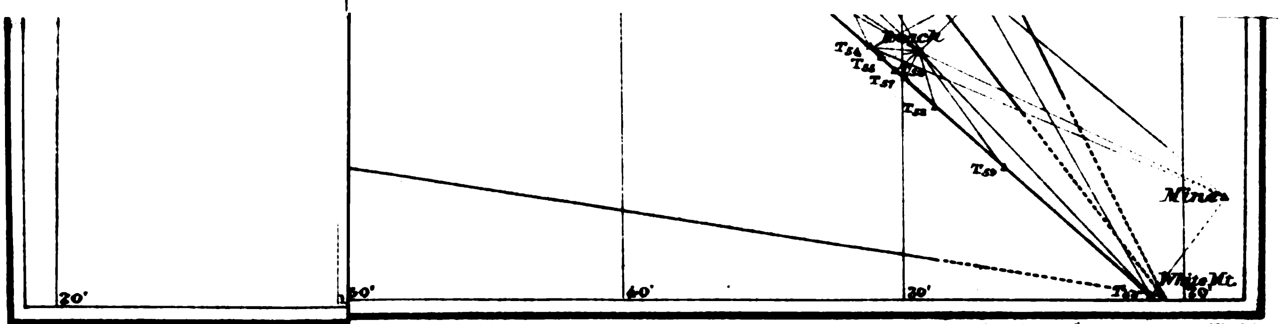



37°00′
110°



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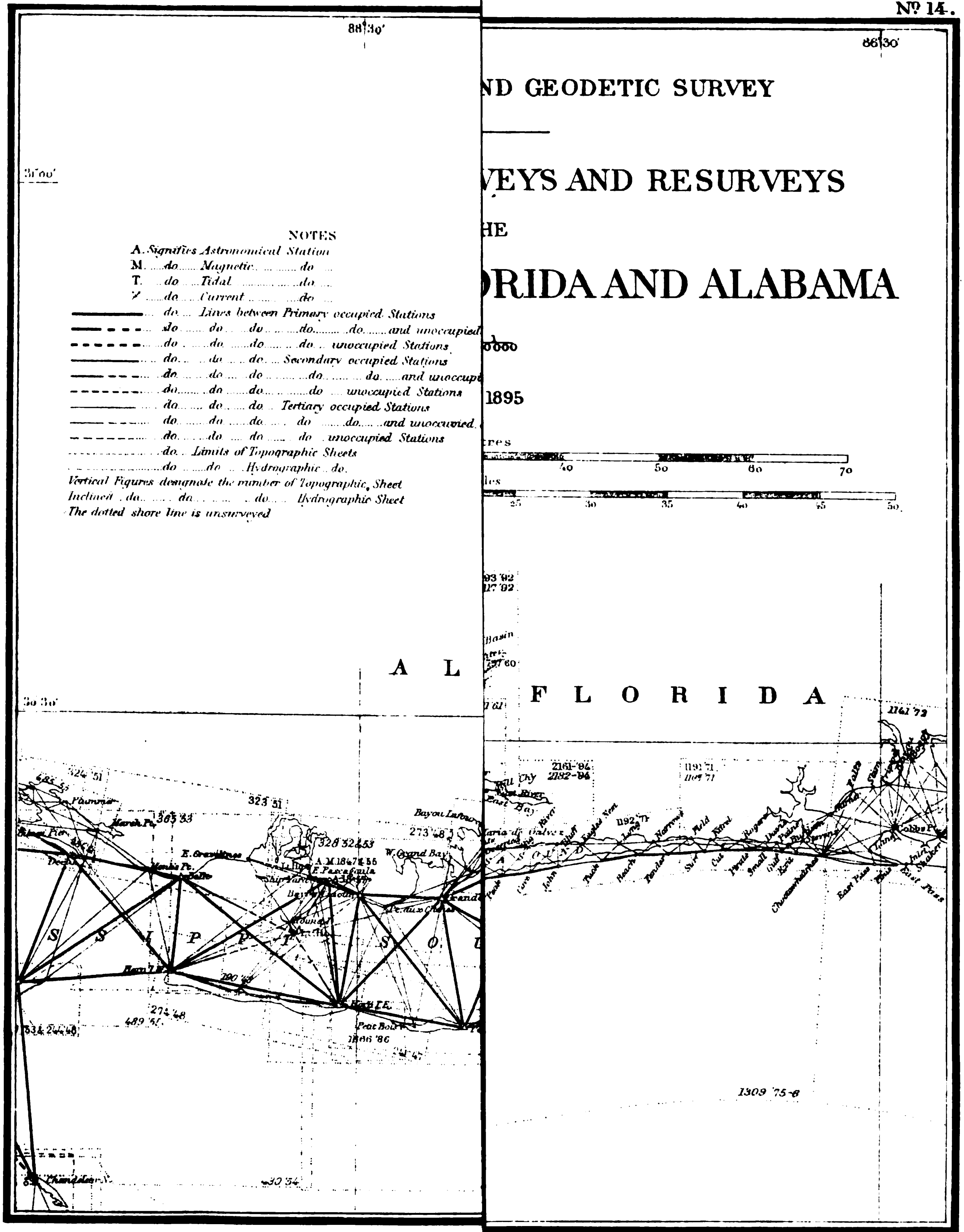
50 60 70 80

mile nearly. One statute mile = 1609.35 metres

Mt. Hood



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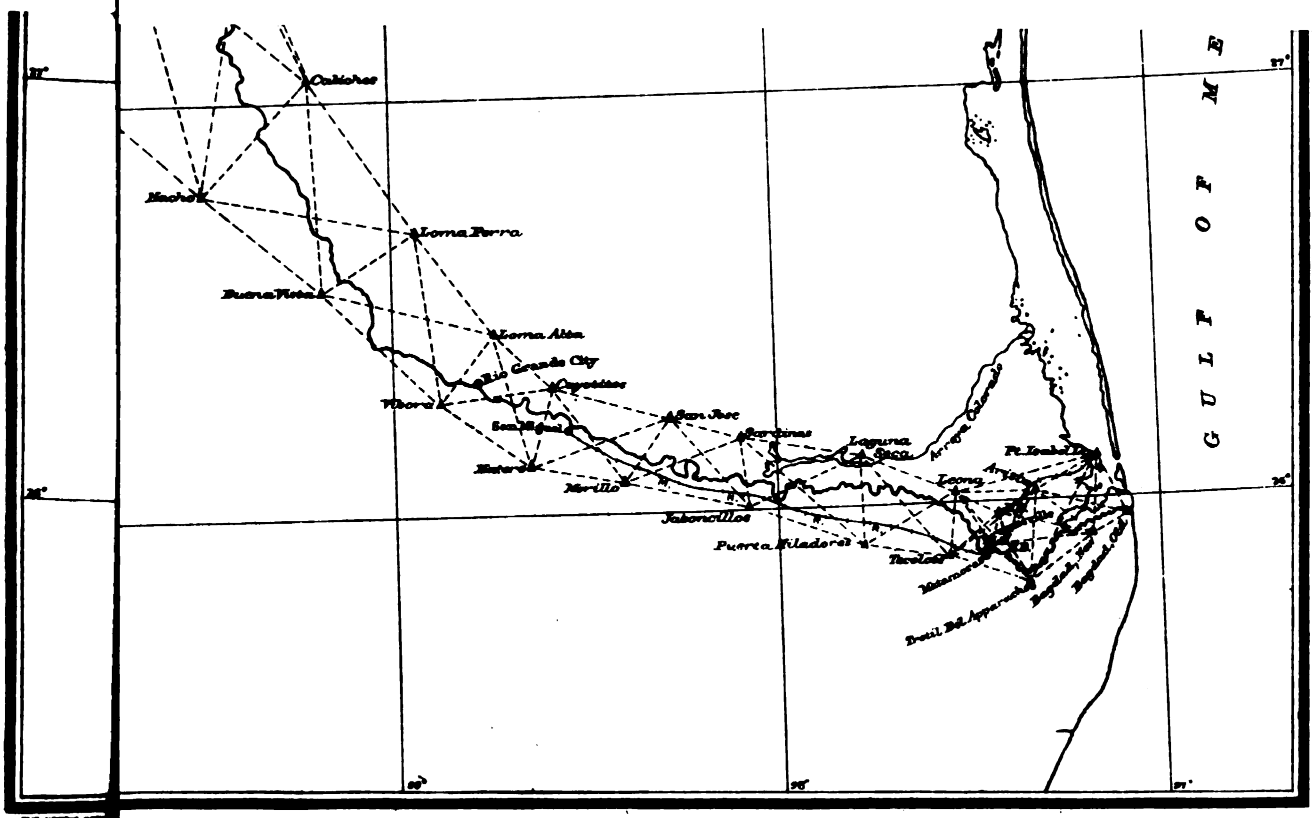
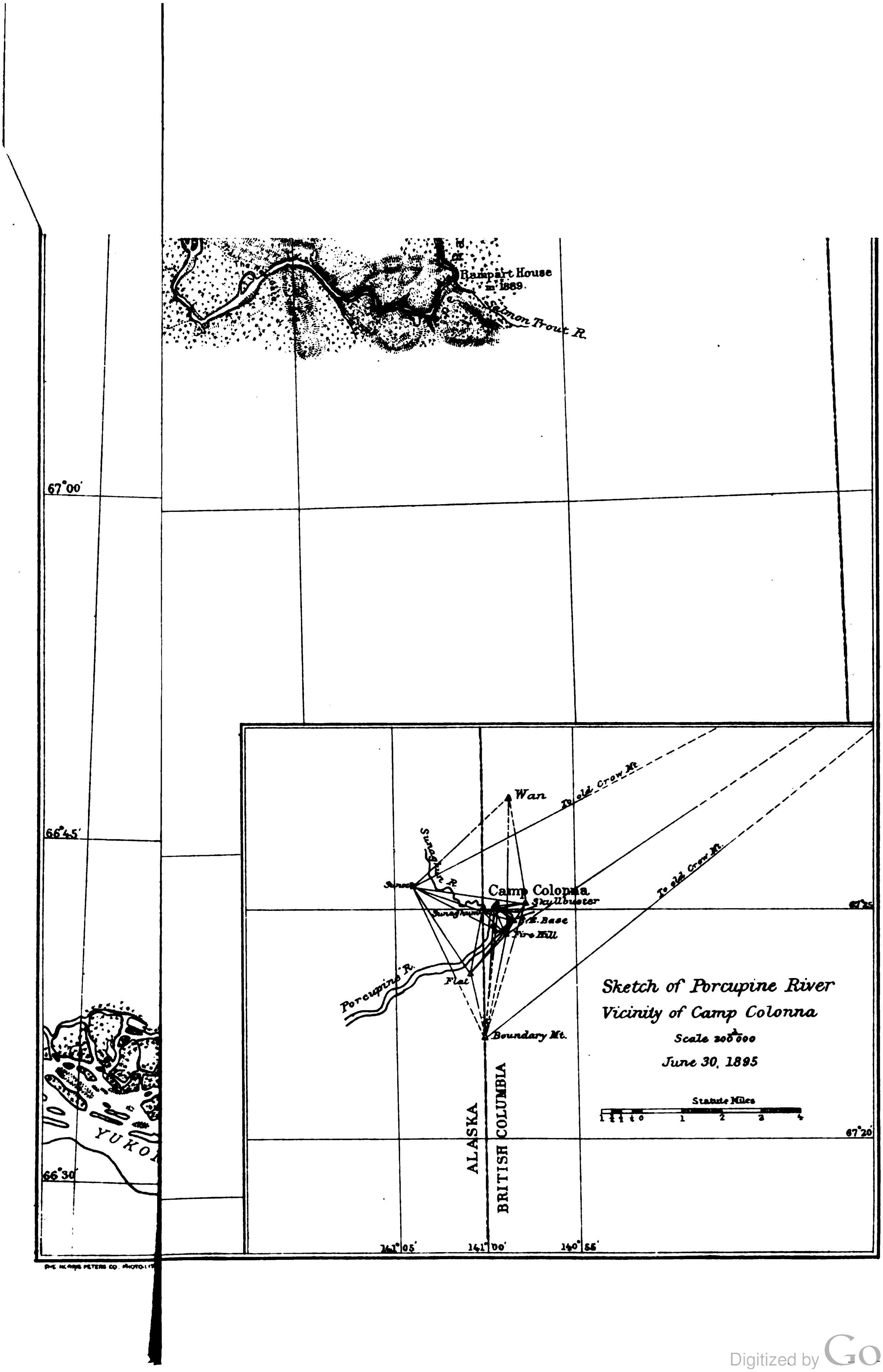
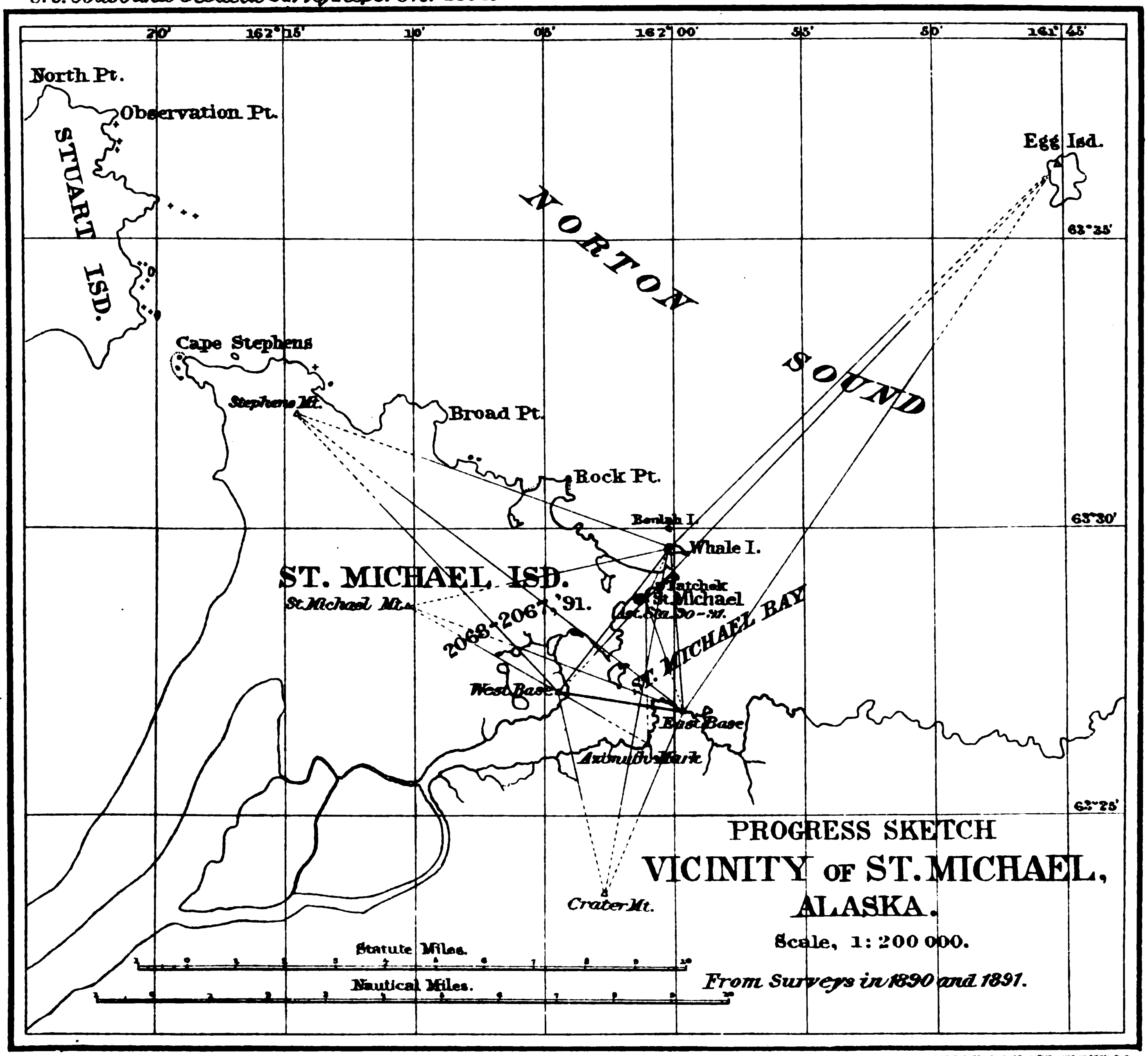

Loma Perra
Buena Vista
Loma Alta
Rio Grande City
Vibora
San Miguel
San Jose
Mirillo
Jaboncillos
Puerta Miladores
Laguna
Seca
Arroyo Colorado
Leona
Pt. Isabel
Tecolote
Matamoros
Bagdad
GULF OF ME


Rampart House
in 1889
Salmon Trout R.
67°00'
66°45'
66°30'
YUKO
Wan
To old Crow Mt.
Camp Colonna
Skullbuster
E. Base
Fire Hill
Porcupine R.
Flat
Boundary Mt.
To old Crow Mt.
Sketch of Porcupine River
Vicinity of Camp Colonna
June 30, 1895
Statute Miles
67°25'
67°20'
ALASKA
BRITISH COLUMBIA
141°05'
141°00'
140°55'



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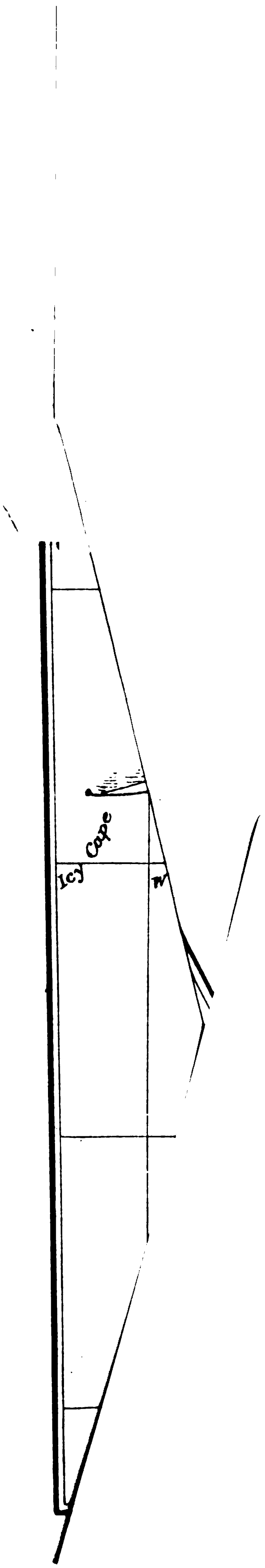
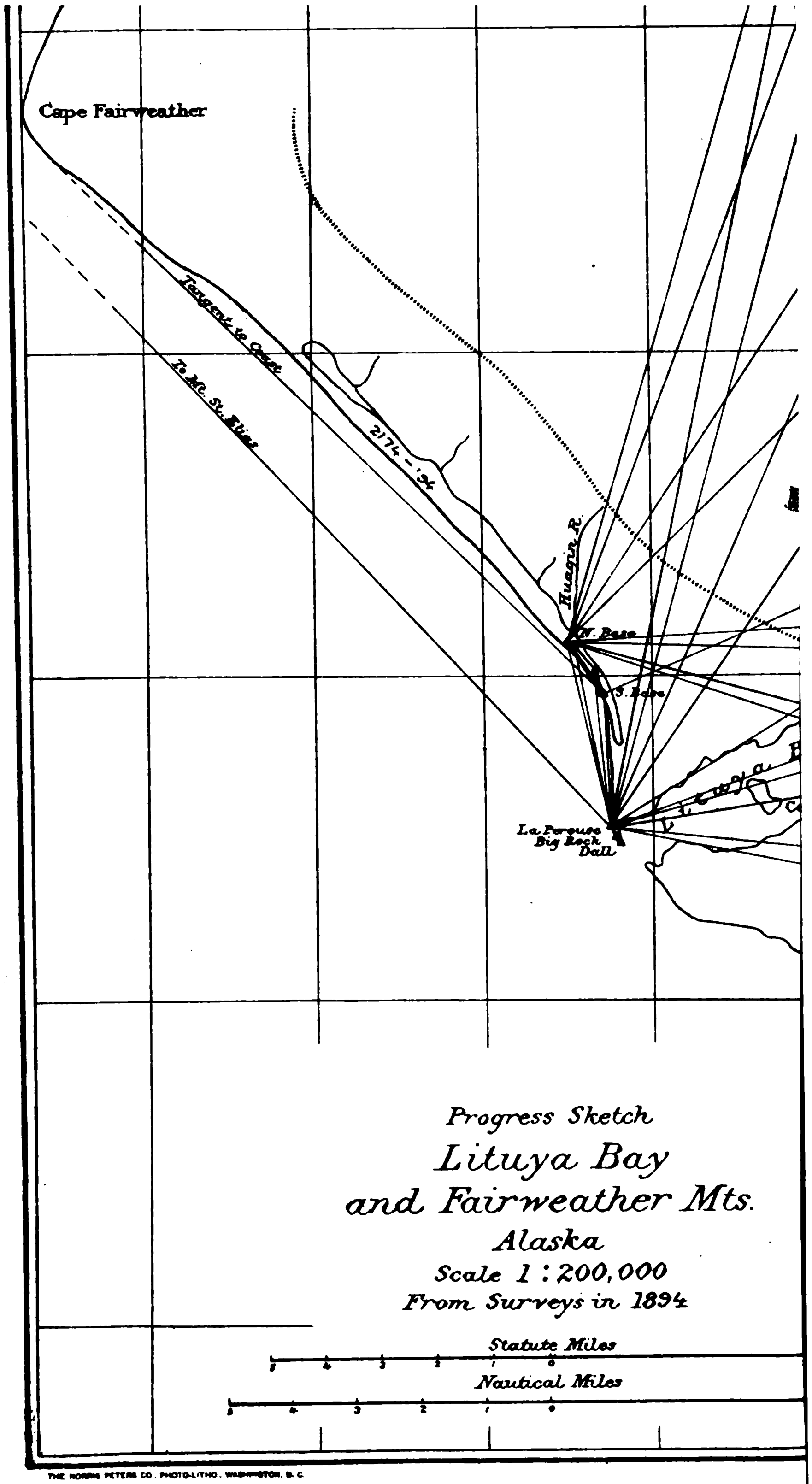

Icy Cape



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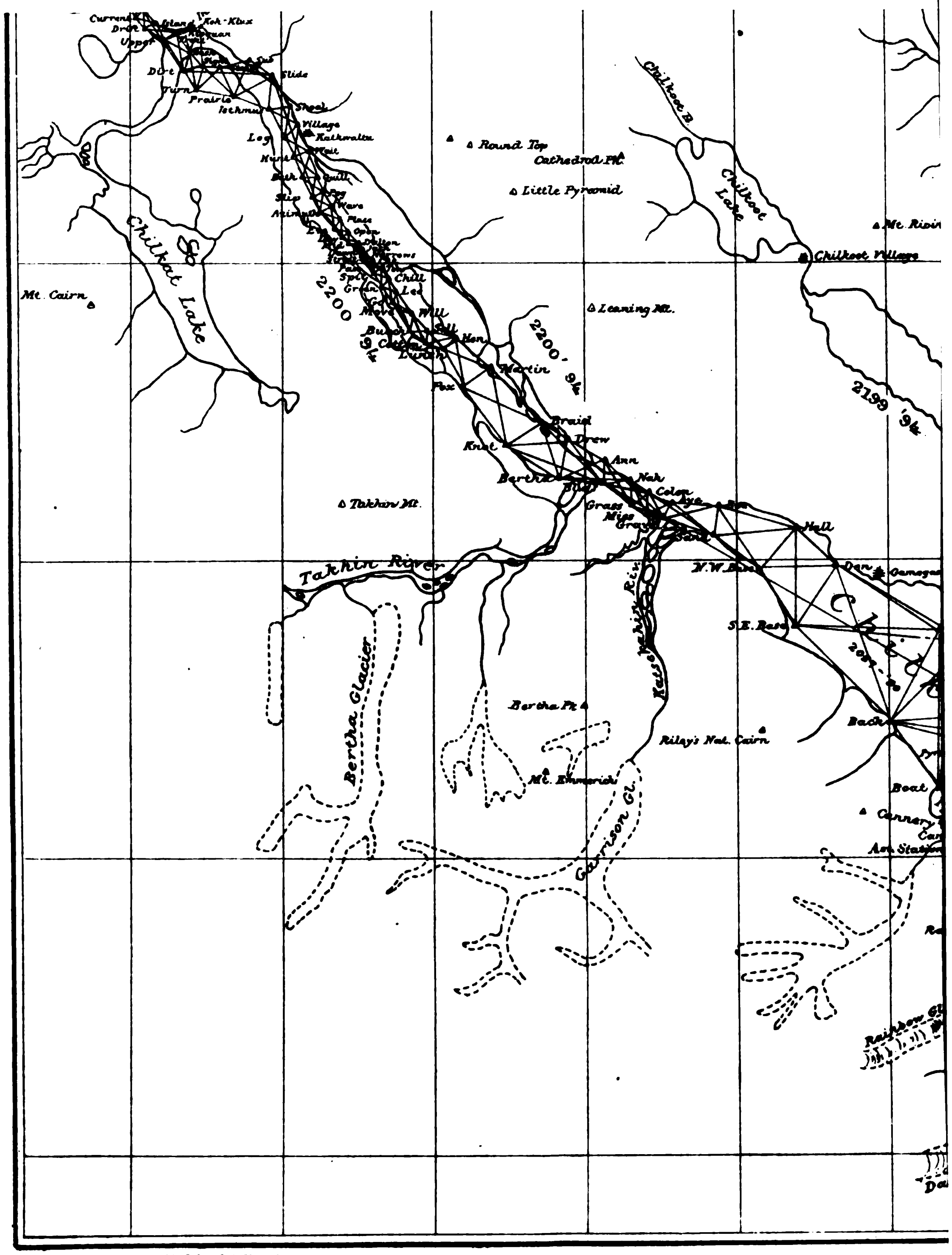

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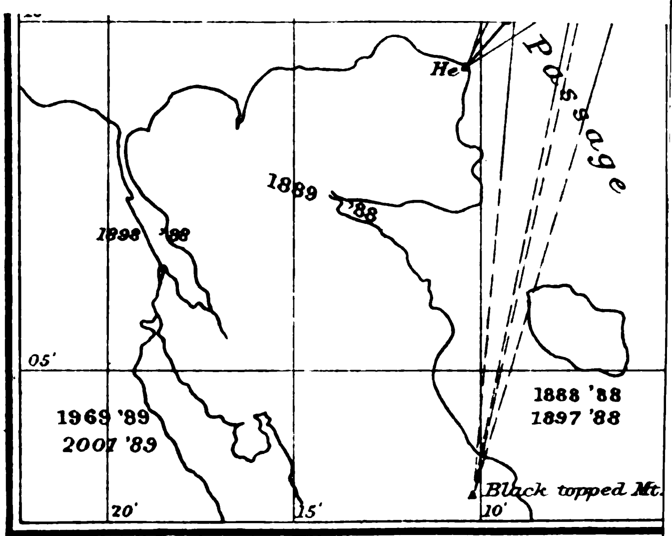
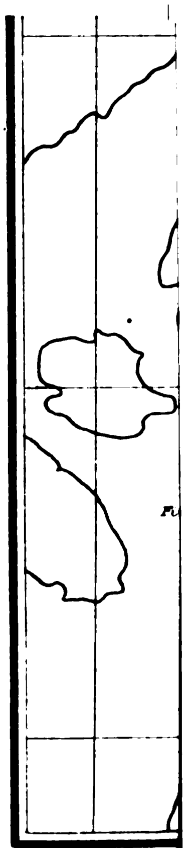

He
Passage
1889 '88
1898 '88
05'
1969 '89
2007 '89
1888 '88
1897 '88
Black topped Mt.
20'
15'
10'



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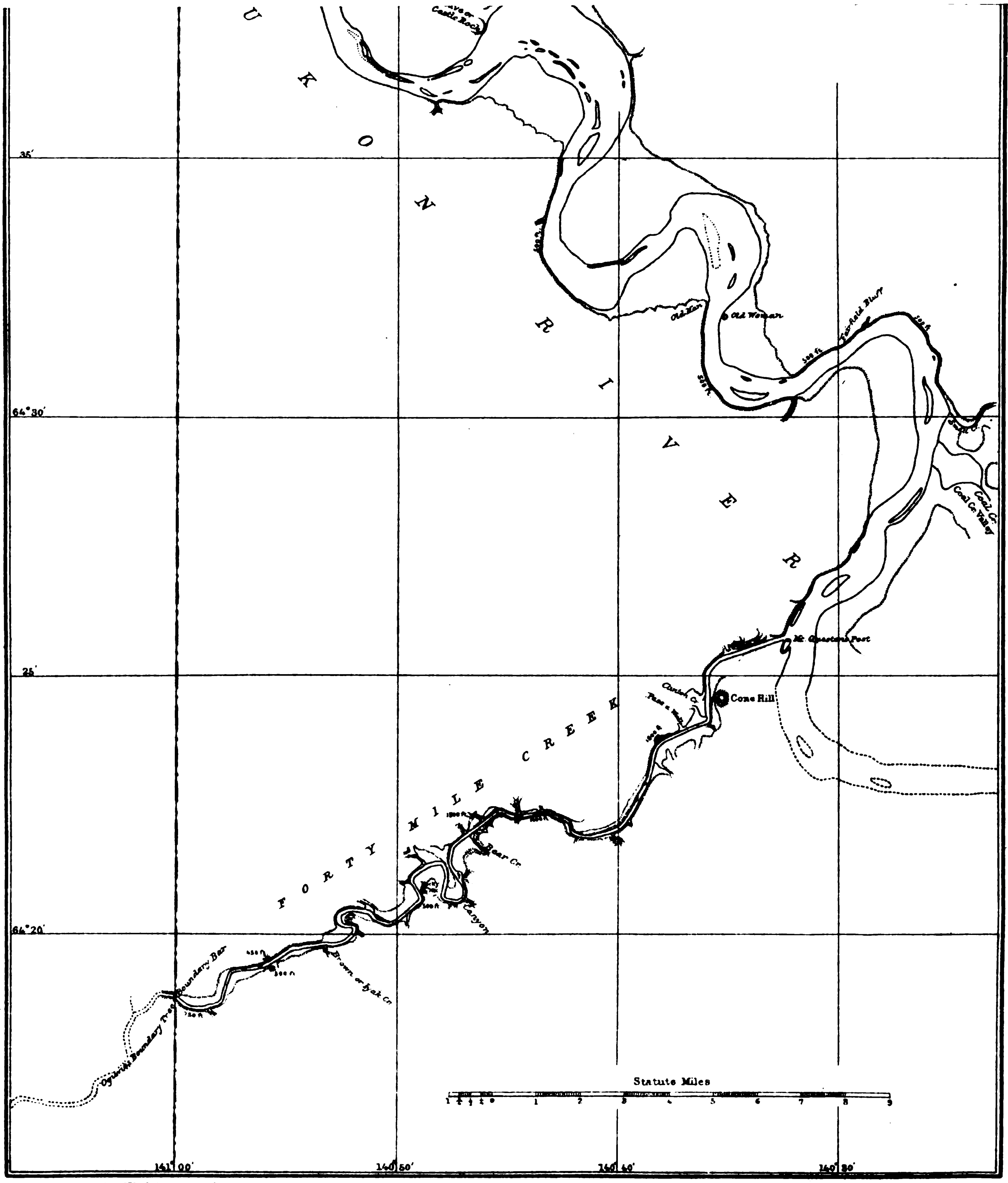

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UNITED STATES COAST AND GEODETIC SURVEY.

PART II.

APPENDICES RELATING TO THE METHODS, DISCUSSIONS, AND RESULTS OF THE COAST AND GEODETIC SURVEY.

ILLUSTRATIONS.

TO APPENDIX NO. 1.

TO APPENDIX NO. 5.

TO APPENDIX NO. 6.

TO APPENDIX NO. 7.

TO APPENDIX NO. 8.

TO APPENDIX NO. 9.

APPENDIX No. 1—1895.

THE SECULAR VARIATION IN DIRECTION AND INTENSITY, OF THE EARTH'S MAGNETIC FORCE IN THE UNITED STATES AND IN SOME ADJACENT FOREIGN COUNTRIES.

By CHARLES A. SCHOTT,
Assistant, Coast and Geodetic Survey.

Eighth edition, with one chart and three plates.

Introduction.—In the magnetic researches of the Survey of preceding years, it has been pointed out that, in the present imperfect state of our knowledge of the secular variation of the magnetic declination, the deductions and expressions so far obtained need continued attention and improvements in order to keep them in close conformity with observations. Accordingly we shall present here the later results, up to date, since the publication of the last edition (seventh) of the "Secular variation of the magnetic declination in the United States, etc.," which forms Appendix No. 7 in the report for 1888,* and give special attention to those more restricted contributions to our knowledge of the secular variations of the magnetic inclination (or dip) and of the magnetic intensity. With respect to these latter variations the present discussion is simply an extension of what had been attempted in Parts II and III of the paper "Magnetic dip and intensity with their secular variation and geographical distribution in the United States," forming Appendix No. 6 in the report for 1885. The present paper thus comprises the results of a study of the secular variations separately of the declination and of the dip, as well as of their combination; in this way we gain a more comprehensive view of our subject. When first attempted, in the report for 1885, the combination was restricted to an average change at a few places in the New England States, and was there illustrated by a diagram. Following up this latter course, more satisfactory and fruitful results can be reached than by the separate discussions, still, so far as the United States is concerned, the dip observations are all of comparatively recent date, and the intensity measures in any country can only date from 1833 at the earliest. When first attempted this combination of the horizontal and vertical components of the direction of a freely suspended needle could yield but meager results in comparison with those which we may now derive from it after the lapse of ten years of additional data.

Of the several long period motions of the magnetic needle, that of its horizontal direction is of the most interest to the Survey, on account of its practical value, since charts must be supplied with the magnetic declination (variation of compass) for the date of issue, as well as with the annual change (due to the secular variation) in order that the information may be made to apply to any not very distant subsequent year. The discovery of a gradual change in the declination, which had at first been supposed by philosophers to be constant for any one place, is due to Gellibrand, of Gresham College, England. In 1635 he published a work entitled "A discourse mathemeticall on the Variation of the Magneticall Needle, together with its admirable diminution lately discovered." He based his conclusions upon the recorded observations of Boroughs (1580), of

*We shall, however, exclude from the present discussion the European and the southern hemisphere stations, formerly included, as no longer required in this connection.

Gunter (1622), and on his own observations (1633–34), showing that in the vicinity of London the direction of the needle had changed in the interval fully 7° to the westward. From this time the fact of the secular variation was completely established, and was verified at all stations where observations had been obtained at distant intervals; the motion, however, varying systematically in speed and direction, according to time and the geographical position of the place. The dip and intensity are undergoing similar variation. It remained for later times to develop the laws governing this remarkable change, and to endeavor to find out its cause. In this latter respect, so far, science has not met with any success, and in the absence of any promising theoretical support for the explanation of the phenomenon, our efforts and investigations should continue to be specially directed toward the elucidation of facts in order to provide for a basis upon which theory may be grounded, or by which it may be tested.

In order that the secular variation may not be confounded with any of the many other variations exhibited by the magnetic needle, a short account of some of the changes, periodic or otherwise, is here retained from the preceding editions.

The magnetic declination.—The magnetic declination (or variation of the compass, as it was formerly called by surveyors and still is by navigators) at any place is the angle contained between two vertical planes, one being the astronomic or true meridian and the other the plane in which the horizontal axis of a freely suspended magnet lies at the time. The former plane is fixed and the latter variable, since it is found that the needle is generally in a state of slow or tremulous motion. The magnetic declination varies with respect to space and time; it is therefore necessary to give with the statement of its measure the exact time (year, day, and hour) when an observation was made, as well as the geographic position of the place (the latitude and longitude to the nearest minute of arc will suffice). The declination is called "west" when the *north* end of the magnet points to the west of true north; algebraically this fact is indicated by a + sign, and if "east" by a — sign. It is a matter of observation that the magnet, when light and delicately suspended (by a single fiber of raw silk), is seldom or never at rest, but is always shifting its direction, or is in a state of oscillation or of tremor, or, it may be subject to sudden changes. These angular motions have been classified as regular (periodic) and irregular variations, and of these we propose to briefly notice the principal ones, such as may generally be exhibited within the limits of the United States.

The solar diurnal variation consists in a systematic angular movement of the magnet, having for its period the solar day. Its phases depend on local time, and its character is the same for the greater part of the northern hemisphere, viz, about the time of sunrise the *north* end of the needle is generally found approaching to or near its most *easterly* deflection or elongation from the magnetic meridian. This phase happens, for instance, at Philadelphia, on the yearly average, about 8^h a. m.; at Key West, Fla., about $8\frac{1}{4}^h$ a. m., and the same at Madison, Wis. It is subject to an annual variation, being about three-quarters of an hour later in the months when the sun is south of the equator, and about one-half of an hour earlier in the summer months, than its yearly average time of occurrence. The north end of the needle then begins its principal daily motion and reaches the opposite extreme position, or its western elongation, about half past 1 o'clock p. m. It is reached a few minutes earlier in summer and a few minutes later in winter, and hardly varies half an hour for different localities. After this epoch the needle takes up an easterly movement, and gradually returns nearly to the direction from which it set out in the morning. Frequently an interruption, or small reversed motion, is exhibited during the night. At Philadelphia the average daily direction is reached in summer about $10\frac{1}{4}^h$ a. m., and in winter about $10\frac{3}{4}^h$ a. m., and generally within half an hour of these times at other places. The magnetic meridian is crossed a second time, generally between 7 and 9 p. m. The angular range between the morning and afternoon elongations, or the diurnal range, is about $8'$ on the average at Philadelphia, and about $5\frac{1}{2}'$ at Key West; in higher magnetic latitudes it is more, in lower less. This range is subject to an annual inequality, being much more conspicuous in summer than in winter ($12'$ at Philadelphia in August and $5'$ in November). At Sitka, Alaska, the average range of the diurnal variation, from observations made between 1848 and 1862, was $10\frac{3}{4}'$, with the easterly extreme at 8 o'clock a. m. and the westerly extreme about $3\frac{1}{2}^h$ p. m. At Point Barrow, on the Arctic Ocean, in latitude 71° 18′, the daily range is nearly $40'$, with an easterly extreme declination about 8^h a. m.

and an apparently delayed westerly extreme about 5^h p. m. At Lady Franklin Bay, Grinnell Land, in latitude 81° 44′, the daily range on the yearly average rises to 1° 6′, with an easterly extreme apparently at the early hour of $1\frac{1}{2}^h$ a. m., and a westerly extreme about 1^h p. m. The diurnal variation is further subject to a periodic inequality related to the eleven-year cycle of the sun spots. It is least in years of minimum sun spots (as in 1856, 1867, 1878, and 1889, for instance) and greatest in years of maximum sun spots (as in 1860, 1870, and 1883), the factors being 0·7 and 1·3, about, of the average amount of these years, respectively. This daily variation appears at times intensified, at other times enfeebled, and during the winter months there are occasionally days on which it cannot be recognized. Observations must be corrected for time of day, in order to reduce the result to the average direction of the twenty-four hours. A table given for this purpose is found in Coast and Geodetic Survey Report for 1881, Appendix No. 8, article 6.

The *annual variation* of the declination is so small that a mere mention of its existence suffices; its amplitude is at most $1\frac{1}{2}$ minutes of arc.

The *variation* depending on the *solar rotation* has a period of about twenty-six days; its amplitude is likewise small in our latitude.

The lunar inequalities.—These we also pass over on account of their small amplitude. The principal inequality is the lunar diurnal variation, exhibiting the peculiarity of two maxima and two minima on each lunar day, thus partaking of the character of tides. The range of this inequality at Philadelphia is about 27″, and at Toronto, Canada, about 38″. Other lunar inequalities are of yet smaller order.

The *secular variation* of the magnetic declination—our subject proper—is most probably also of periodic character, but since it requires centuries for its full development, and since, as yet, no one cycle has actually been completed within the range of accurate observation, we are obliged, in the absence of any reliable theory, to follow up the phenomena by continuous observations. The secular motion may be compared with a wave motion or with an oscillation of a pendulum which comes to rest momentarily at its extreme positions or elongations, and moves fastest midway between these extremes. Smaller variations within this period have also been detected, but the general angular movement (say, of the north end) of the magnet may be described as follows: About the times of maximum deflection the magnet appears almost stationary or only slowly oscillating about the same average direction for several years (as observed by ordinary or rough instruments); soon, however, the effect of the secular change becomes perceptible, increasing gradually, year by year; this progressive angular motion soon reaches a maximum annual value, after which, still moving in the same direction, it slowly diminishes in speed and finally becomes again stationary when now at the opposite extreme digression, after which possibly it will return again to its first position. Within the area of the United States and south of latitude 49° a complete oscillation of this kind may require between two and a half and three and a half centuries, during which time the magnet would swing twice, i. e., once forward and once backward, through an arc of several degrees, generally keeping within limits of 5° and 8° of total range for our geographical boundaries according to present information; in other localities the period and range are very much greater.

To illustrate further the effect of the secular change, we may take the case of New York City. In this locality the needle was observed to be in nearly a stationary condition, about 1660, its north end pointing then about $9\frac{3}{4}$° to the west of north; it then moved easterly and reached its easternmost digression about 1784, showing at that time only $4\frac{1}{2}$° west declination. Ever since this epoch the motion has been westerly, its present value approaching 9° W.; the greatest annual change (nearly 5′) was apparently passed about the middle of the century. The times of these stationary epochs are different at different localities; the last epoch of eastern elongation was noted earliest in Maine toward the close of the past century, later in the Mississippi Valley, and it has now reached the coast of California and Washington. At present over nearly the whole of the United States, excepting Alaska, the effect of the secular change is to *increase* west declination or (what is the same) to *decrease* east declination; but on parts of the Pacific Coast and for some short distance in the interior the effect is still opposite, viz, an *increase* of east declination. There must, consequently, be a region or belt of no change at present, which will be referred to in detail further on. It is this regular motion, known as the secular variation, which renders it necessary

to reconstruct isogonic charts from time to time and to change the compasses and magnetic bearings on our charts. Although this secular variation is supposed perfectly systematic, it may not always appear so, especially when deduced from few observations made at different places in the same general locality, either on account of small observing errors or in consequence of local deflections, or for the reason that ordinary periodic variations and inequalities have not been fully eliminated from the results. Among the latter irregularities must be classed the—

Magnetic disturbances or storms.—These may occur at any time, and are, when taken individually, beyond the power of prediction; but attacked by the statistical method, i. e., when classified, and when averages are taken of many thousands and then analyzed, they are found to be subject to various laws. Their presence is generally indicated by sudden deflections, and by rapid and great fluctuations in the direction of the needle as compared with its normal position, which otherwise might have been expected at that time of day and month. They often take place simultaneously over distant regions of the globe, and in duration may be confined to a few hours, or they may last a day or even for several days. They are frequently accompanied by auroral lights and by strong electric earth currents. When analyzed in large numbers they exhibit a solar-diurnal variation, the westerly and easterly disturbances, however, following different laws. They also have an annual variation and seem to depend largely on the sun-spot period or an eleven-year cycle. Irrespective of direction of the disturbing forces, the most disturbed hours of the day are generally those between 7^h and 10^h a. m., and the least disturbed those between 2^h and 6^h p. m. Westerly disturbances occur most frequently about 8^h a. m. and least about 8^h p. m.; they exhibit a single daily progression. Easterly disturbances reach a maximum about 8^h p. m. and a minimum about 2^h p. m.; they exhibit a double daily progression. Westerly and easterly disturbances appear to agree in their annual variation, in their times of maxima, i. e., in August, September, and October, and in their times of minima, i. e., in January and June. The disturbances are most frequent and considerable in the years of maximum sun-spot activity and the reverse in years of minimum sun spots. The following table of the observed disturbances, in a bi hourly series at Philadelphia in the years 1840 to 1845, will give an idea of their relative frequency and magnitude:

Deviations from normal direction.	Number of disturbances.
3′·6 to 10′·8	2 189
10 ·8 to 18 ·1	147
18 ·1 to 25 ·3	18
25 ·3 to 32 ·6	3
Beyond.	0

At Key West, Fla., the maximum deflection noticed between 1860 and 1866 was 21′·4. At Madison, Wis., where the horizontal magnetic intensity is considerably less, very much larger deflections have been noticed. Thus, on October 12, 1877, one of 48′, and May 28, 1877, one of 1° 24′.

In high magnetic latitudes, where the horizontal component of the magnetic force is very feeble, the disturbances attain great intensity. Thus at Lady Franklin Bay, Lieutenant Greely noted an extreme range of declination of not less than 20° 28′, this occurring during the great November storm of 1882.

We now proceed to the consideration of the combined horizontal and vertical motion of a needle free to place itself in the line of the magnetic resulting force.

Supposing a freely suspended magnetic needle to indicate at any time the direction of the earth's total magnetic force, and to be placed with its middle point in the center of an imaginary sphere, and an eye placed there and looking in the direction of the north end of the needle, this momentary direction may be referred to the interior surface of the sphere; then successive positions, due to secular change, will give a series of points which for continuous motion will trace out a curve characteristic of the secular variation of the place. This curve is the intersection of an irregular conical surface generated by the motion of the directive line and the surface of the

sphere, and if we imagine a plane surface placed tangent to the sphere at a point where the average direction would intersect it, we can get the secular trace projected on that plane, as seen from the center of the sphere. To construct it, we have given in the horizontal direction the observed variations in the declination, and secondly in the vertical direction we have the observed variations in the inclination; the former must be multiplied by the cosine of the dip to refer them to the depressed direction of the total force. It will be noticed that the direction of the motion in the trace given in the report for 1885 is the same as that of the hands of a clock; and this, from extended researches of Dr. L. A. Bauer, has since been proved to hold at all stations for which sufficient data were available.[1] The secular variation in the total intensity could also be indicated in the diagram by increasing the thickness of the trace in proportion to the increase of the force and thinning it out for decreasing force.

Restricting our attention to the secular variation of the declination and dip, experience has shown that either can be represented analytically by a periodic function, even in its most simple form as a sine or cosine function; at the same time there is ground for believing it to be ultimately of a complex character, consisting rather of a series of large and superposed small waves of definite period and amplitude than of a single forward and backward swing. We have as yet no proof of the phenomenon being truly periodic, so that the present recognized secular variation curve, as explained above, would be retraced hereafter; indeed it is far more probable that the period or periods are variable, such, for instance, as would give the curve a spiral aspect with varying convolutions. However this may be, the principal periods at present assigned to the several stations, as satisfying observations, are found not of a common length.

In Appendix No. 7, Report for 1888, it is pointed out that for stations near our Atlantic Coast, and for many places in the interior, the period implied and demanded in the representative formulæ is about two and one-half centuries; for stations on our western coast (south of Alaska) rather more than three centuries; and for Gulf stations about three and one-half centuries. On the other hand, I have shown in Appendix No. 3, Report for 1891 (part 2, octavo), that certain South American, South Atlantic, and South African stations demand for their representations a secular period of about five and one-third centuries, or fully double the time required at our North Atlantic stations. Besides this contrast in the duration, there is a still greater one in the range of the secular variation, the ratio of an average amplitude (half range) at stations on the New England coast (say of 3°) is to that for stations in the southern hemisphere, above referred to (say of 13½°), as is 1 to 4½. While this nonconformity to a common length of the secular variation period for the whole globe may render the ultimate explanation of its cause more difficult, it might be surmised that the apparent difference in the duration may be the result of an interference phenomenon between two long periods. Apparent irregularities (possibly loops in the secular trace), due to subordinate cycles, will demand special attention. Referring to the length of the period at any one station we assume at first, as most probable, that it is the same for the representation of the changes in declination, in inclination, and in intensity.

We have next to refer to the motion of the phases of the secular variation as first noticed in the United States. The westward propagation in time of the magnetic phases from our Atlantic coast across the continent to our Pacific coast was described[2] as early as the year 1859, and three years before glimpses of the phenomenon had been obtained. The following statements are taken from the Annual Report for 1874, p. 105: An examination of the column containing the times when the secular variation reached its easterly maximum deflection, shows that the needle attained a stationary condition and then commenced a reverse motion in the New England States toward the end of the past century; in the Atlantic States to the westward and southward, this condition was reached early in the present century, and in Mexico about the first third of the century; in California, Oregon, and Washington it has not yet reached this extreme value. The epoch of eastern magnetic elongation is traced from Halifax, Nova Scotia, where it occurred about 1711 to San

[1] See Beiträge zur Kenntniss des Wesens der Säcular-Variation des Erdmagnetismus, von Louis A. Bauer. Inaugural Thesis. Berlin, 1895. The author, who was at one time connected with the computing division of the Survey, here extends his researches to prominent stations in the northern and southern hemispheres, and finds the direction at all of them to be clockwise.

[2] Coast Survey Report for 1859, App. No. 24, p. 299; see also Rept. for 1856, p. 235.

Francisco, Cal., where it was predicted to occur about the year 1907. We are thus directed to the extreme Northeastern States for probable indications of what may be expected to follow in more Southern and Western States. Apparently considerably more than a century will have elapsed before the influence, which toward the close of the past century produced the change of motion of the north end of the needle from eastward to westward in Maine (increasing there the westerly declination), arrives and is noted in California and Oregon (diminishing there the easterly declination). By the time the *western* elongation is reached in Maine, we may expect to see the needle in California, Oregon and Washington not far from its *eastern* elongation, or in opposite phase. We have thus, as a fact, that a certain phase of the secular variation noted at a given station will be found to have at some previous time passed at another station east (magnetically) of it, and hence indicating what may be expected shortly to occur at the first station. This remark applies equally to other phases and to the variations in dip and intensity. Quite lately this feature of the secular variation in declination and inclination has been further successfully pursued by Mr. L. A. Bauer,[1] who followed it up so as to include stations all around the globe.

The earliest attempt on the part of the Survey to pass from the observed annual changes of the magnetic dip to the more comprehensive study of its secular variation was in 1856,[2] but it could not be called successful on account of the scanty material then available. Among the earliest dates of observation within the limits of the United States or adjacent thereto are those of the year 1778, on the west coast of North America, and on the eastern side the observations at Cambridge of 1780–1783; and here we have to note the earliest known dip observation in the United States, to which attention was lately called by Professor Abbe. Observed at Boston in 1722, it was recovered by Dr. L. A. Bauer and is quoted in his inaugural paper. The subject was left in abeyance till 1885,[3] when the investigation was resumed under more favorable conditions and in connection with that of the secular change of the horizontal component of the force and also of the total force.[4] In neither case, however, could periodic functions be employed on account of the shortness of the record and they are now only given for Cambridge and Boston.

Analytical representation of the secular variation.—The circular or harmonic functions which adapt themselves with facility to the representation of periodically recurring phenomena will here be used in all cases where the length of the period or of periods can be established together with the amplitude and epoch. This applies in general to the declination changes, but for the variations in dip and intensity we are frequently restricted to the use of a series of powers, which is undesirable on account of its limited application in time. Of the two forms the periodic formulæ—

$$D=\delta+r\sin(\alpha m+c)+r_{,}\sin(2\ \alpha m+c_{,})+r_{,,}\sin(3\ \alpha m+c_{,,})+\ .\ .\ .\ .$$

$$\text{and } D=\delta+r\sin(\alpha m+c)+r_{,}\sin(\ \alpha_{,}m+c_{,})+r_{,,}\sin(\ \alpha_{,,}m+c_{,,})+\ .\ .\ .\ .$$

the second one is preferred, as it directly admits of the introduction of subordinate waves; in general the first periodic term, however, is found sufficient.

When applied to the variation in declination, let—

m=number of years and fraction of year counted from a given fixed epoch t_0 for which 1850·0 has been adopted, hence for any time (year) t we have $m=t-t_0=t-1850{\cdot}0$.

$\alpha\ \alpha_{,}\ \alpha_{,,}$ . . . . are coefficients depending on the length of the periods $P\ P_{,}\ P_{,,}$ . . . . of the several terms; so that $\alpha=\frac{360}{P}$ $\alpha_{,}=\frac{360}{P_{,}}$ $\alpha_{,,}=\frac{360}{P_{,,}}$ and in general $\alpha_1=\frac{2\pi}{P_1}$. Thus the values for α 0·9, 1·0, 1·2, 1·5 correspond to periods of 400, 360, 300 and 240 years, respectively.

$r\ r_{,}\ r_{,,}$ . . . . are the semi-ranges or amplitudes of the several waves.

$c\ c_{,}\ c_{,,}$ . . . . are epochal constants of the several waves.

δ=a constant representing an average or normal value of the declination about which the periodic fluctuations take place.

D=the value of the declination for the time t, assumed positive when the north end of the needle is west of the true meridian, and negative when east of it.

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[1] See his Inaugural Thesis of 1895.

[2] Appendices Nos. 32 and 33, Report for 1856.

[3] Appendix No. 6, Report for 1885.

[4] For first attempt, see Appendix No. 22, Report for 1861.

The quantities α $\alpha_{,}$ $\alpha_{,,}$ .... c $c_{,}$ $c_{,,}$ .... r $r_{,}$ $r_{,,}$ .... and δ must be determined for any one locality from the observations made there at various times and the most probable values must be found by application of the method of least squares. The annual change a of the declination due to the secular motion is positive for increasing west declination or diminishing east declination and negative for an opposite direction. Differentiating the expression for D we get

$$dD = r\alpha \cos(\alpha m + c)\, dm + r_{,}\alpha_{,} \cos(\alpha_{,} m + c_{,})\, dm + \ldots.$$

For any time t and when a is expressed in minutes of arc

$$a = 60 \text{ arc } 1^{\circ} \left[r\alpha \cos(\alpha m + c) + r_{,}\alpha_{,} \cos(\alpha_{,} m + c_{,}) + \ldots. \right]$$

Maxima and minima values of D follow from

$$o = r\alpha \cos(\alpha m + c) + r_{,}\alpha_{,} \cos(\alpha_{,} m + c_{,}) + \ldots.$$

The probable error e_0 of an observation (of unit weight) is found from the differences Δ of the n observed and computed values of D by means of

$$e_0 = 0{\cdot}674 \sqrt{\frac{\Sigma \Delta^2}{n - n_{,}}}$$

where $\Sigma \Delta^2$=sum of squares of differences and $n_{,}$=number of unknown quantities entering into the expression for D and determined from the observations themselves, thus if but a single periodic term is used $n_{,}=4$. If different weights p $p_{,}$ $p_{,,}$ are assigned to the observations we must substitute $p\,\Delta^2$ for Δ^2 in the above expression to get the probable error of an observation of unit weight.

In applying the above formulæ the value of α is found by trial so as to produce the best general representation; if we put $\delta = \delta_{,} + x$ where $\delta_{,}$=an assumed approximate value of δ and x a correction to it, also take $y = r \cos c$ and $z = r \sin c$ then the conditional equations for any periodic term will take the form

$$o = \delta_{,} - D + x + y.\, \sin \alpha m + z.\, \cos \alpha m$$

and the values of x, y, z are found from the normal equations; when weights enter, the conditional or observation equations must be multiplied by the square root of their respective weights p. Subordinate terms, short in time and small in range, are best introduced by Cauchy's method of nterpolation in the form

$$d_{,} = \delta_{,} + r_{,}.\, \cos c_{,} \sin m\alpha_{,} + r_{,}.\, \sin c_{,}.\, \cos m\alpha_{,}.$$

For those stations where the scarcity of observations compels the use of a series of powers, as frequently occurs in the case of dips θ or intensities F we have the form

$$\theta = \theta_0 + y\,(t - t_0) + z\,(t - t_0)^2 + u\,(t - t_0)^3 + \ldots.$$

where for t_0 we adopt generally 1850·0 as before; putting $\theta = \theta_{,} + x$ where $\theta_{,}$=an approximate value for θ_0 we have the observation equation in the form

$$o = \theta_{,} - \theta + x + y\, m + z\, m^2 + u\, m^3 + \ldots.$$

the annual change a is given by

$$\frac{d\theta}{dt} = a = y + 2\,z\,(t - t_0) + 3\,u\,(t - t_0)^2 + \ldots.$$

and the time of a maximum or minimum value is given by $o = y + 2\,z\,(t - t_0) + 3\,u\,(t - t_0)^2 + \ldots.$ also the point of inflexion by $\frac{d^2\theta}{dt^2} = o = 2\,z + 6\,u\,(t - t_0) + \ldots.$

The principal difficulty met with in the reduction of the analytical formulæ to the numerical expressions for the magnetic stations is the disposal of the large discrepancies between certain computed and observed values, i. e., to decide whether the difference is due to defective observation or to inadequate representation by the formula. No general rule can here be given whether to reject an observation or to give it fractional weight, but with a knowledge of the magnitude of the probable observing error applicable to each century, and with the help of approximately contemporaneous observations at other stations in the vicinity, the difficulty can generally be overcome. It is not alone our object to render the sum of the squares of the residuals a minimum, but to establish an expression nearest to a physical truth. It may also be remarked in this place

that in proportion as our knowledge of the law of secular variation is increasing in certainty, the material upon which it is based must be criticized with greater severity.

For a proper estimation of the length of applicability of our formulæ the fact should be borne in mind that however well they may represent the secular variation of the declination during the present century and during the greater part of the preceding one, when extended into the seventeenth and sixteenth centuries they weaken and fail. We can not altogether neglect the older data; crude as they are, and however defective, they possess, when properly weighted, some value by concurrent testimony; for instance, we can not assume that the agonic line for the year 1600 was totally in error when placed so far to the west as to traverse Mexico. (See Appendix No. 6, C. & G. S. Rept. for 1888.) To reconcile the older with the modern observations so as to bring them under the same analytical expression is a task yet to be performed.

The arrangement of the subject-matter of this paper is the same as that found in former reports, but the record and discussion of the declination is followed immediately by that of the dip and of the intensity. The observations and other related data for each station are collected chronologically, and the stations are arranged in geographic order, depending on their latitude, and the whole area of the United States is subdivided into three regions or groups of stations, viz:

Group I: All stations lying between the Atlantic Coast and the divide of the Appalachian range; it also includes some foreign stations to the north of it.

Group II: All stations in the central part of the United States between the Appalachian range and the Rocky Mountain divide; also some foreign stations, particularly in the West Indies.

Group III: All stations between the Rocky Mountain divide and the Pacific Coast; also the whole of Alaska, some stations in Mexico, and other foreign stations contiguous to our borders.

COLLECTION, DISCUSSION, AND RESULTS OF MAGNETIC DECLINATIONS, DIPS AND INTENSITIES IN THE UNITED STATES AND AT SOME CONTIGUOUS FOREIGN STATIONS.

This section of the paper may be regarded as a new edition of Appendix No. 7, Report for 1888, and with respect to dip and intensity as a second edition of Appendix No. 6, Report for 1885, with additions of new observations (and of old ones re-covered). It was therefore thought unnecessary to repeat the references or authorities to the observations with such fullness as was given in those papers, since they may be looked up there; the references to the new stations, however, are in full. As already remarked, observations at certain foreign stations, as also the discussion of observations made on our western coast by Spanish navigators during 1774–1790 have now been omitted, likewise the discussions of a number of declinations along our Atlantic Coast about the epochs 1700 and 1750 and the remarks about the position of the magnetic pole (where $\theta=90°$) and some other matter, for which the reader may be referred to the 1888 report.

In order to properly estimate the magnitude of the discrepancies between computed and observed declinations ($C-O$ of the tables) it may be well to bear in mind that in the century following the time of Columbus and of the Cabots, navigators were content to note their variation to the nearest point or half point of the compass, and that the observations of Hudson and Champlain in the first decade of the seventeenth century are not to be depended on within about half a point, say $\pm 5°$. About the beginning of the eighteenth century a great improvement in accuracy is notable; thus Bering's observations[1] in the vicinity of Kamchatka in the years 1725–1730 are found subject to a probable error of but $\pm 1\frac{1}{4}°$; the observations made by Cook in the years 1768–1780 are estimated to be uncertain by about 1°; observations made by Spanish navigators[2] along our west coast between 1774–1790 were found subject to a probable error of $\pm 51'$ and this appears to have remained an ordinary uncertainty down to our time, owing to the disturbing influence of the masses of iron and steel since employed in shipbuilding and propulsion. It is otherwise on land, where compass bearings may be made with an uncertainty less than $\frac{1}{6}°$ (provided the index error is attended to and allowance is made for the diurnal variation of the declination); since the portable declinometers came into use (after 1838) the purely observing error has practically disappeared, since it has been reduced below the variations of the declination from day to day.

[1] Coast and Geodetic Survey Report for 1891, part 2, p. 272.
[2] Coast and Geodetic Survey Report for 1888, p. 269.

The general directions of the Survey recommend observations to be made on two or three days at the times of the morning and the afternoon elongations in order to secure a result which may be expected subject to a probable error of about $\pm 1'$.

When in any circumscribed locality different stations are occupied at different times, the effect of the regular as well as of any irregular distribution of the magnetism in this region should be allowed for; if this can not be done the effect appears as error. It is only in a few cases that this "reduction to station" could be made. This source of discrepancy between observed and computed values greatly weakens the values deduced for the secular variation. The amount can not be definitely stated, but not infrequently it exceeds 1°.

The earliest dip observations may be estimated as uncertain by $\frac{1}{4}$°; the probable error of an observed value in the earlier part of this century may be taken between $\pm 10'$ and $\pm 5'$, but this was greatly reduced with the introduction of the Kew circles, by means of which the dip may be had within $\pm 2'$ or even less.

As to the uncertainty of the results for the horizontal force it may be estimated as between $\frac{1}{300}$ and $\frac{1}{500}$ part of the force, for any one complete measure; for mere relative measure, and when starting from a magnetic observatory with a carefully determined value, much greater accuracy can be reached, but for absolute measures with portable magnetometers the instrumental constants require to be determined with the utmost care in order to exceed the accuracy implied above. The tabular values of H and F are now expressed in centimetre gramme second units. For converting measures expressed in f. g. s., or British units, into c. g. s. units we use the multiplier 0·0461080 (or log. factor: 8·663776) and for the converse operation the multiplier 21·6382 (or log. factor: 1·336224).

For convenience of reference I add here some relations between the quantities θ, H, V, and F.

$$F=(H^2+V^2)^{\frac{1}{2}} \qquad dF=\sec\theta\, dH+F\tan\theta\, d\theta \qquad \frac{dF}{F}=\frac{dH}{H}+\tan\theta\, d\theta$$

$$F=H\sec\theta \qquad dH=-F\sin\theta\, d\theta+\cos\theta\, dF \qquad \frac{dF}{F}=\cos^2\theta\frac{dH}{H}+\sin^2\theta\frac{dV}{V}$$

$$H=F\cos\theta \qquad d\theta=-\frac{dH}{F\sin\theta}+\frac{\cot\theta}{F}dF \qquad \frac{dV}{V}=\operatorname{cosec}^2\theta\frac{dF}{F}-\cot^2\theta\frac{dH}{H}$$

$$V=F\sin\theta=H\tan\theta \qquad dV=\operatorname{cosec}\theta\, dF-\cot\theta\, dH \qquad \frac{dV}{V}=\frac{d\theta}{\sin\theta\cos\theta}+\frac{dH}{H}$$

$$dV=H\sec^2\theta\, d\theta+\tan\theta\, dH$$

The application of our empirical formulæ should generally be limited in time to the period covered by the observations and in particular no undue extension should be made with respect to declinations to reach back to the sixteenth and seventeenth centuries, since indications are not wanting that not only considerable modification, but more probably entire reconstruction of the formulæ will be required to satisfy the law then prevailing. The tabular results should not be extended (either way) unless supported by observations.

In the following tables we have 47 stations in Group I, 39 in Group II, and 32 in Group III, or in all 118 stations, with an aggregate of nearly 1 435 declination observations (annual values), 577 dip results, and 479 intensity (horizontal component) measures.

GROUP I.

Secular variations of the magnetic declination, dip and intensity.

[Eastern stations.]

ST. JOHN'S, NEWFOUNDLAND.

$\varphi = 47° 34'.4 \qquad \lambda = 52° 41'.9$ W. of Gr.

[Government House.]

No.	Date.	D.	References and remarks.
		° ′	
1	1665—	14 W.	Approximate values taken from the isogonic charts of these years given in W. Van Bemelen's De Isogonen in de XVI en XVII Eeuw. Utrecht, 1893. His earlier charts do not seem to me trustworthy in this region. R. Dudley's Arcano del Mare, Florence, 1646–47, for about 1620, is less doubtful; it gives 15°. No use is made of it here. See Appendix No. 6, C. & G. S. Rep. for 1888.
2	1680—	13 W.	

Secular variations of the magnetic declination, dip and intensity—Continued.

ST. JOHN'S, NEWFOUNDLAND—Continued.

No.	Date.	D.	References and remarks.
		° ′	
3	1700—	15 W.	Edm. Halley's Tabula Nautica, Variationum Magneticarum index, etc.
4	1750—	17¾ W.	A value deduced by me from observations at various places about that period. C. and G. S. Bulletin No. 6, May, 1888. The value + 16° for 1787 depending on a chart of Hansteen's appears to be defective.
5	1833—	26½ W.	P. Barlow's isogonic chart.
6	1844, Oct.	29 36 W.	Capt. Bayfield, R. N.
7	1857, July.	31 21 W.	Capt. Dayman, R. N.
8	1862, Sept. 11.	31 20 W.	Capt. Orlebar, R. N.
9	1863, Sept. 22.	31 18 W.	
10	1864, June 3.	31 00 W.	
11	1866, Apr. to Oct.	30 55 W.	Near Government House.
12	1881, June 29.	30 26 W.	Lieut. C. P. Perkins, U. S. N.
	1881, Sept. 26, 27, 28.	30 37·3 W.	Lieut. S. W. Very, U. S. N.
13	1885—	30 45 W.	Brit. Adm'y Chart 298; with remark: "Mag'c Var'n nearly stationary."

$$D = +22^\circ{\cdot}16 + 8{\cdot}71 \sin(1{\cdot}1\,m + 70^\circ{\cdot}42)$$

Date.	Obs'd D.	*p*.	Comp'd D.	C — O.	Date.	Obs'd D.	*p*.	Comp'd D.	C — O.
	°		°	°		°		°	°
1665·5	+14·0	½	+15·75	+1·75	1862·7	+31·33		+30·83	—0·50
1680·5	13·0	½	14·37	+1·37	1863·7	31·30		30·84	—0·46
1700·0	15·0	¾	13·48	—1·52	1864·4	31·00		30·84	—0·16
1750·0	17·75	½	16·61	—1·14	1866·5	30·92		30·87	—0·05
1833·0	26·5	¾	29·00	+2·50	1881·6	30·52		30·57	+0·05
1844·8	29·60		30·03	+0·43	1885·5	+30·75		+30·37	—0·38
1857·5	+31·35		+30·70	—0·65					

DIP AND INTENSITY AT ST. JOHN'S.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1881, Sept. 26, 27, 28.	74 37	0·1522	0·5736	Lieut. S. W. Very, U. S. N. About Government House.
2	1883, June 28.	74 47	0·1518	0·5784	W. H. Lamar and F. W. Ellis, U. S. Signal Corps; old cemetery on Church Hill.

QUEBEC, CANADA.

$\varphi = 46^\circ\ 48'{\cdot}4 \qquad \lambda = 71^\circ\ 14'{\cdot}5$ W. of Gr.

[Wolfe's monument.]

No.	Date.	D.	References and remarks.
		° ′	
1	1642—	16 W.	Padre Bressani.
2	1686—	15½ W.	De Hayes.
3	1700—	16 W.	Edm. Halley's Tabula Nautica } Mean used.
	1700—	16½ W.	C. & G. Survey Bulletin No. 6 } Mean used.
4	1750—	12½ W.	C. & G. Survey Bulletin No. 6.
5	1785—	12 35 W.	Surveyor-General Holland.
6	1789, June 30.	11 45 W.	L. Perrault.
7	1791, June 22.	13 00 W.	P. Beaupré.
8	1792, Mar. to May.	12 42 W.	J. B. Demers, A. Dezery, C. Turgeon, and F. Legendre. Mean value.
9	1793—	12 05 W.	Holland } Mean used.
	1793, Nov.	13 00 W.	J. C. Antill } Mean used.

Secular variations of the magnetic declination, dip and intensity—Continued.

QUEBEC, CANADA—Continued.

No.	Date.	D.	References and remarks.
		° ′	
10	1805, Apr.	11 35 W.	Department record.
11	1810—	11 00 W.	Becquerel } Mean used.
	1810, June 5.	12 15 W.	E. T. Fletcher } Mean used.
12	1811, June.	12 15 W.	Department record.
13	1814—	11 50 W.	Kent.
14	1820, Oct. and Nov.	12 32 W.	Bourdage, Fletcher, and Livingstone. Mean value.
15	1821, Aug. to Nov.	12 54 W.	J. McNaughton, A. Cattanach, W. Ware, and E. Tetu. Mean value.
16	1822, Jan. to May.	13 00 W.	J. Hamel, P. Verrault, P. J. Bureau, and Department record.
17	1823, Mar. to Nov.	13 00 W.	N. Le François, D. S. Ballantyne, J. Gamahe, A. Bochet, and L. Dorval.
18	1824, Mar. 2.	12 40 W.	A. Cattanach.
19	1831, July to Dec.	13 24 W.	Capt. Bayfield, T. Carroll, J. Hamel, H. Corey, and J. Newman. Mean value.
20	1832, May.	13 00 W.	Department record.
21	1833, May and July.	12 45 W.	" "
22	1834, Mar. and July.	13 19 W.	Capt. Bayfield, Fletcher, and Department record. Mean value.
23	1835, Dec.	13 10 W.	Department record.
24	1838–39	13 22 W.	" "
25	1840, May and Sept.	13 42 W.	R. M. Moore and Bouchette. Mean value.
26	1842, Dec.	14 01 W.	Anse des Mères, Lefroy. Mean value.
27	1846—	14 32 W.	La Canardière and Fletcher.
28	1847, Sept. and Oct.	14 38 W.	Department record.
29	1848, Feb. to Oct.	14 35 W.	Department record and Le François. Mean value.
30	1849, Mar. and July.	15 22 W.	Department record.
31	1850, Apr.	15 15 W.	" "
32	1851, autumn.	15 15 W.	" "
33	1853, Jan. 19.	15 30 W.	" "
34	1858, Oct. 8.	15 34 W.	Capt. Orlebar, R. N.
35	1859, July 19.	16 17 W.	C. A. Schott, U. S. Coast Survey.
36	1860, Oct. 12.	16 28 W.	Capt. Orlebar, R. N.
37	1865—	16 40 W.	E. T. Fletcher.
38	1879, Sept. 16, 19.	17 13·7 W.	J. B. Baylor, U. S. Coast and Geodetic Survey.
39	1887—	17 40 W.	Brit. Adm'y Chart No. 319, with note: Decl'n increasing 3′ annually.
40	1889, Jan. 1.	17 14 W.	Lieut. Aubry. Annuaire pour l'an 1891.
41	1890—	17 30 W.	U. S. Hyd. Office. Chart No. 1207, with remark: Variation nearly stationary. [Probably a computed value.]

$$D = +14^\circ{\cdot}66 + 3{\cdot}03 \sin(1{\cdot}4\,m + 4^\circ{\cdot}6) + 0^\circ{\cdot}61 \sin(4{\cdot}0\,m + 0^\circ{\cdot}3)$$

Date.	Obs'd D.	p.	Comp'd D.	C − O.	Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°		°		°	°
1642·5	+16·00		+17·00	+1·00	1834·4	+13·31		+13·22	−0·09
1686·5	15·50		17·33	+1·83	1835·9	13·17		13·36	+0·19
1700·0	16·25	½	16·49	+0·24	1839·3	13·37		13·70	+0·33
1750·0	12·50	½	12·14	−0·36	1840·5	13·71		13·81	+0·10
1785·5	12·58		12·24	−0·34	1842·7	14·02		14·07	+0·05
1789·5	11·75		12·22	+0·47	1846·5	14·53		14·49	−0·04
1791·5	13·00		12·20	−0·80	1847·7	14·64		14·63	−0·01
1792·3	12·42		12·20	−0·22	1848·5	14·58		14·72	+0·14
1793·6	12·54		12·17	−0·37	1849·4	15·37		14·84	−0·53
1805·3	11·58		12·08	+0·50	1850·3	15·25		14·93	−0·32
1810·5	11·62		12·08	+0·46	1851·7	15·00		15·10	+0·10
1811·5	12·25		12·09	−0·16	1853·1	15·50		15·26	−0·24
1814·5	11·83		12·14	+0·31	1858·8	15·57		15·89	+0·32
1820·8	12·54		12·33	−0·21	1859·5	16·28		15·97	−0·31
1821·7	12·90		12·36	−0·54	1860·8	16·47		16·09	−0·38
1822·2	13·00		12·39	−0·61	1865·5	16·67		16·54	−0·13
1823·6	13·00		12·45	−0·55	1879·7	17·23		17·38	+0·15
1824·2	12·67		12·49	−0·18	1887·5	17·67		17·51	−0·16
1831·7	13·40		12·99	−0·41	1889·0	17·23		17·51	+0·28
1832·4	13·00		13·05	+0·05	1890·5	+[17·50]		17·51	......
1833·5	+12·75		+13·14	+0·39					

Secular variations of the magnetic declination, dip and intensity—Continued.

QUEBEC, CANADA—Continued.

DIP AND INTENSITY AT QUEBEC.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1842, Sept. 1.	77 15·3	0·1394	0·6318	Sir J. H. Lefroy and Lieut. C. Younghusband. Near Artillery Barracks.
	1845, June 23.	77 08·8	0·1400		Sir J. H. Lefroy and Lieut. C. Younghusband. Near Wolfe and Montcalm monuments.
2	1859, June 18, 19.	77 17·5	0·1379	0·6270	C. A. Schott, U. S. Coast Survey. Near Wolfe's monument.
3	1879, Sept. 16, 19.	76 45·1	0·1431	0·6243	J. B. Baylor, U. S. Coast & G. S. Near Wolfe's monument.

CHARLOTTETOWN, PRINCE EDWARD ISLAND.

$\varphi = 46° \; 14'$ $\qquad \lambda = 63° \; 27'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1833—	19½ W.	P. Barlow's isogonic chart.
2	1842, June.	21 03 W.	Capt. Bayfield, R. N.
3	1857, May.	23 02 W.	Capt. Orlebar, R. N.
4	1858, May 18.	22 54 W.	
5	1859, May 20.	22 51 W.	
6	1860, May 17.	22 50 W.	
7	1861, May 14.	22 45 W.	
8	1862, May 27.	23 19 W.	
9	1875·3	23 03 W.	British officers, U. S. Hydr. Office Doc. 109*a*, Washington, 1895.
10	1876·3	23 32 W.	
11	1879·3	23 54 W.	
12	1880·3	22 49 W.	
13	1881·3	22 55 W.	
14	1882·3	22 51 W.	
15	1883·3	22 52 W.	
	1883, Aug. 29.	24 02 W.	Lieut. J. C. Rich, U. S. N. Red'n to town —45′. Mean of 3 values 23° 14′.
	1883, Sept. 22.	24 19 W.	Lieut. R. B. Peck, U. S. N.
16	1886·3	22 42 W.	British officers, U. S. Hydr. Office Doc. 109*a*, Washington, 1895.
17	1888—	22 52 W.	U. S. Hydr. Office, Chart No. 1068, variation decreasing 2′ annually. [Possibly a computed value.]

$D = +15°·50 + 7·72 \sin (1·05m + 58°·6)$. An approximate expression.

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.	Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°		°		°	°
1833·0	+19·50	½	+20·54	+1·04	1876·3	+23·53		+23·20	—0·33
1842·4	21·05		21·47	+0·42	1879·3	23·90		23·22	—0·68
1857·4	23·04		22·57	—0·47	1880·3	22·82		23·22	+0·40
1858·4	22·90		22·63	—0·27	1881·3	22·92		23·22	+0·30
1859·4	22·85		22·68	—0·17	1882·3	22·85		23·21	+0·36
1860·4	22·83		22·73	—0·10	1883·6	23·24		23·20	—0·04
1861·4	22·75		22·78	+0·03	1886·3	22·70		23·17	+0·47
1862·4	23·32		22·83	—0·49	1888·5	[+22·87]	½	+23·13	+0·26
1875·3	+23·05		+23·19	+0·14					

No observations (so far as known) for dip and intensity at Charlottetown.

Secular variations of the magnetic declination, dip and intensity—Continued.

MONTREAL, CANADA.

$\varphi=45° 30'.5$ $\lambda=73° 34'.6$ W. of Gr.

[McGill University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700—	14¾ W.	C. & G. Survey Bulletin No. 6.
2	1749, Aug. 1.	10 38 W.	M. Gillion in P. Kalm's travels, etc. London, 1771. Vol. 3.
	1750—	10½ W.	C. & G. Survey Bulletin No. 6. Not used.
3	1785—	8 24 W.	Surveyor-General Holland.
4	1793, July 26.	8 15 W.	J. McCarthey.
5	1814—	7 45 W.	Becquerel.
6	1834—	8 00 W.	Capt. Bayfield, R. N.
7	1835—	9 50 W.	Communicated by V. Colvin.
8	1842, Aug.	8 57.6 W.	Sir J. H. Lefroy.
9	1859, July 20.	12 21 W.	C. A. Schott, U. S. Coast Survey. Grounds of McGill University.
10	1879, Sept. 25.	13 40.5 W.	J. B. Baylor, U. S. Coast & G. S. Grounds of McGill University.
11	1893—	14 24 W.	U. S. Hydr. Office. Chart No. 1353, with note: increasing annually 3′. [Probably a computed value.]

$$D=+11°.87+4.33 \sin (1.45\, m-18°.8)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1700.0	+14.75	½	+15.47	+0.72
1749.5	10.63		10.71	+0.08
1785.5	8.40		7.86	—0.54
1793.6	8.25		7.61	—0.64
1814.5	7.75		7.80	+0.05
1834.5	8.00		9.01	+1.01
1835.5	9.83		9.10	—0.73
1842.6	8.97		9.74	+0.77
1859.5	12.35		11.49	—0.86
1879.7	13.67		13.63	—0.04
1893.5	+14.40		+14.89	+0.49

DIP AND INTENSITY AT MONTREAL.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1833—	77 06	......	......	Capt. Back, R. N.
2	1838—	76 19 (?)	......	......	Estcourt.
3	1842, Sept. 16.	77 13.1	0.1400	0.6326	Sir J. H. Lefroy. At St. Helens Isle, near artillery barracks.
4	{ 1843, Apr. 25, 29.	77 08.8	0.1411	0.6344	Sir J. H. Lefroy.
	{ 1843, Aug.	....	0.1433	0.6280	Dr. A. D. Bache.
5	1845, June 20.	77 08.5	0.1389	0.6241	Lieut. C. Younghusband. Foot of Mountain.
6	1859, July 20.	76 51.4	0.1434	0.6307	C. A. Schott, U. S. Coast S. Grounds of McGill University.
7	1879, Sept. 25.	76 25.7	0.1471	0.6270	J. B. Baylor, U. S. Coast & G. S. Grounds of McGill University.

$$\Theta=77°.08-0.011\,1\, m-0.000\,382\, m^2$$
$$H=0.140\,2+0.000\,015\, m+0.000\,007\,3\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1833.5	77.10	77.16	+0.06
1842.7	77.22	77.14	—0.08
1843.3	77.15	77.14	—0.01
1845.5	77.14	77.12	—0.02
1859.5	76.86	76.94	+0.08
1879.7	76.43	76.41	—0.02

Date.	Obs'd H.	Comp'd H.	C—O.
1842.7	0.1400	0.1405	+0.0005
1843.5	0.1422	0.1404	— 18
1845.5	0.1389	0.1403	+ 14
1859.5	0.1413	0.1410	— 03
1879.7	0.1471	0.1471	0.0000

Secular variations of the magnetic declination, dip and intensity—Continued.

MONTREAL, CANADA—Continued.

COMPUTED DECENNIAL VALUES.

Date.	D.	θ.	H.	F.
	°	°		
1830	+ 8·7	77·15	......	......
1840	9·5	77·15	0·1408	0·6331
1850	10·5	77·08	402	271
1860	11·6	76·93	411	240
1870	12·6	76·70	434	233
1880	13·7	76·40	472	260
1890	14·6	76·02	525	312
1900	+15·4	75·57	0·1592	0·6388

EASTPORT, ME.

$\varphi = 44°54'\!\cdot\!4 \qquad \lambda = 66°59'\!\cdot\!2$ W. of Gr.

[Fort Sullivan.]

No.	Date.	D.	References and remarks.	
		° ′		
1	1604–1612.	17 32 W.	Champlain. Observed on Douchet Island, St. Croix River.	
	1620, about.	13·4 W.	R. Dudley's Arcano del Mare. Not used.	
		13 W.	Edm. Halley's Tabula Nautica.	
2	1700—	13·3 W.	C. & G. S. Rept. for 1888, p. 306; value deduced from observations at 17 stations.	
3	1750—	11·4 W.	C. & G. S. Rept. for 1888, p. 308; value deduced from observations at 19 stations.	
4	1775—	12 40 W.	Des Barres' Atlantic Neptune. At Grand Menan Island.	
5	1797—	12 19 W.	Chart of mouth of St. Croix River. Red'n to Eastport—5′.	
6	1833—	14½ W.	P. Barlow's isogonic chart.	
	1857, Sept. 16, 19.	15 21·1 W.	G. W. Dean, U. S. Coast Survey, at Calais. Not used.	
7	1860, Aug. to Dec.	17 57·1 W.	G. B. Vose, U. S. Coast Survey.	At Fort Sullivan Magnetic Observatory.
8	1861, Jan. to Dec.	17 59·2 W.	G. B, Vose and S. Walker, U. S. Coast S.	
9	1862, Jan. to Dec.	18 00·6 W.	S. Walker, R. H. Talcott, and E. Goodfellow, U. S. Coast S.	
10	1863, Jan. to Dec.	18 02·3 W.	E. Goodfellow, U. S. Coast S.	
11	1864, Jan. to July, incl.	18 03·7 W.	E. Goodfellow, A. T. Mosman, and H. W. Richardson, U. S. Coast S.	
12	1865, July 22–25.	18 06·1 W.	H. W. Richardson, U. S. Coast S.	
13	1873, Sept. 2, 3.	18 56·0 W.	Dr. T. C. Hilgard, at Fort Sullivan.	
14	1879, Aug. 27, 28.	19 07·8 W.		
15	1887, Aug. 24–26.	18 35·2 W.	J. B. Baylor, U. S. Coast & G. S. Parade Ground, Fort Sullivan.	
16	1895, Aug. 10, 11.	18 53·2 W.		

$$D = +15°\!\cdot\!18 + 3\!\cdot\!79 \sin(1\!\cdot\!25\,m + 31°\!\cdot\!1)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1608·0	+17·53	⅓	+18·95	+1·42	1862·5	+18·01		+17·92	—0·09
1700·0	13·30	½	13·64	+0·34	1863·5	18·04		17·98	—0·06
1750·0	11·40		11·38	—0·02	1864·3	18·06		18·02	—0·04
1775·5	12·67		11·81	—0·86	1865·6	18·10		18·09	—0·01
1797·5	12·32		13·01	+0·69	1873·7	18·93		18·46	—0·47
1833·0	14·50	½	15·81	+1·31	1879·7	19·13		18·68	—0·45
1860·8	17·95		17·28	—0·13	1887·7	18·59		18·87	+0·28
1861·5	+17·99		+17·86	—0·13	1895·6	+18·89		+18·97	+0·08

Secular variations of the magnetic declination, dip and intensity—Continued.

EASTPORT, ME.—Continued.

DIP AND INTENSITY AT EASTPORT.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1860, Jan. to Dec.	75 53·1	0·1525	0·6252	G. B. Vose, U. S. Coast S. (At Magnetic Observatory, Fort Sullivan.)
2	1861, Jan. to Dec.	75 51·0	0·1525	0·6238	G. B. Vose and S. Walker, U. S. Coast S. (At Magnetic Observatory, Fort Sullivan.)
3	1862, Jan. to Dec.	75 48·5	0·1523	0·6211	S. Walker, R. H. Talcott and E. Goodfellow, U. S. Coast S. (At Magnetic Observatory, Fort Sullivan.)
4	1863, Jan. to Dec.	75 48·3	0·1526	0·6225	E. Goodfellow, U. S. Coast S. (At Magnetic Observatory, Fort Sullivan.)
5	1864, Jan. to July.	75 45·8	0·1528	0·6215	E. Goodfellow, A. T. Mosman, H. W. Richardson, U. S. Coast S. (At Magnetic Observatory, Fort Sullivan.)
6	1865, July 22–25.	75 44·7	0·1529	0·6211	Prof. H. W. Richardson, U. S. Coast S. (At Magnetic Observatory, Fort Sullivan.)
7	1873, Aug. 28–Sept. 4.	75 24·3	0·1551	0·6155	Dr. T. C. Hilgard. At Fort Sullivan.
8	1879, Aug. 27, 28.	75 12·2	0·1570	0·6146	J. B. Baylor, U. S. Coast & G. S. At Fort Sullivan.
9	1887, Aug. 24, 26.	74 54·2	0·1573	0·6038	J. B. Baylor, U. S. Coast & G. S. At Fort Sullivan.
10	1895, Aug. 10, 11.	74 37·6	0·1598	0·6028	J. B. Baylor, U. S. Coast & G. S. At Fort Sullivan.

$$\Theta = 76°{\cdot}31 - 0{\cdot}039\,2\,m + 0{\cdot}000\,053\,4\,m^2$$
$$H = 0{\cdot}1502 + 0{\cdot}000\,183\,m + 0{\cdot}000\,000\,6\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1860·5	75·88	75·90	+0·02
1861·5	·85	·86	+ ·01
1862·5	·81	·82	+ ·01
1863·5	·80	·79	— ·01
1864·3	·76	·76	·00
1865·6	·74	·71	— ·03
1873·7	·41	·41	·00
1879·6	75·20	75·19	— ·01
1887·6	74·90	74·91	+ ·01
1895·6	74·63	74·63	·00

Date.	Obs'd H.	Comp'd H.	C—O.
	°	°	°
1860·5	0·1525	0·1522	—0·0003
1861·5	25	23	— 2
1862·5	23	25	+ 2
1863·5	26	28	+ 2
1864·3	28	29	+ 1
1865·6	29	32	+ 3
1873·7	51	49	— 2
1879·6	70	62	— 8
1887·6	73	79	+ 6
1895·6	0·1598	0·1598	0

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1860	+17·79	75·92	0·1521	0·6252
1870	18·32	75·55	41	176
1880	18·71	75·18	62	107
1890	18·92	74·83	0·1584	053
1900	+19·0	74·48	0·1608	0·6010

BANGOR, ME.

$\varphi = 44°\ 48'{\cdot}2$ $\lambda = 68°\ 46'{\cdot}9$ W. of Gr.

[Thomas Hill.]

No.	Date.	D.	References and remarks.
		° ′	
1	1805—	11 15 W.	J. Herrick.
2	1837—	13 04 W.	J. Herrick.
3	1840—	13 22 W.	N. Barker.
4	1844, June to Oct., incl.	14 29 W.	W. P. Parrott and S. Nott.
5	1857, Oct. 13, 14, 15.	15 19·9 W.	G. W. Dean, U. S. Coast S. On Thomas Hill.
6	1879, Aug. 21.	16 29·3 W.	J. B. Baylor, U. S. Coast and G. S. On Thomas Hill.
7	1890, Aug. 20, 21.	16 55·6 W.	J. B. Baylor, U. S. Coast and G. S. On Thomas Hill.
8	1895, Aug. 1, 2.	16 57·4 W.	J. B. Baylor, U. S. Coast and G. S. On Thomas Hill.

Secular variations of the magnetic declination, dip and intensity—Continued.

BANGOR, ME.—Continued.

$D + 13^\circ\cdot60 + 3\cdot60 \sin (1\cdot30\, m + 14^\circ\cdot1)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1805·5	+11·25		+11·11	−0·14
1837·5	13·07		13·47	+0·40
1840·5	13·37		13·71	+0·34
1844·6	14·48		14·05	−0·43
1857·8	15·33		15·08	−0·25
1879·6	16·49		16·46	−0·03
1890·6	16·93		16·91	−0·02
1895·6	+16·96		+17·05	+0·09

DIP AND INTENSITY AT BANGOR.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1841, July.	76 11·6	......	......	Maj. J. D. Graham.
2	1857, Oct. 10–16.	76 14·7	0·1490	0·6265	G. W. Dean, S. Harris, H. W. Bache, U. S. Coast S. } On Thomas Hill.
3	1863, July 10.	76 05·3	0·1477	0·6143	C. A. Schott, U. S. Coast S. } On Thomas Hill.
4	1879, Aug. 21.	75 29·8	0·1529	0·6107	J. B. Baylor, U. S. Coast & G. S. } On Thomas Hill.
5	1890, Aug. 20, 21.	75 13·2	0·1540	0·6036	J. B. Baylor, U. S. Coast & G. S.
6	1895, Aug. 1, 2.	74 59·4	0·1558	0·6016	J. B. Baylor, U. S. Coast & G. S.

$\Theta = 76^\circ\cdot23 - 0\cdot005\ 2\, m - 0\cdot000\ 497\, m^2$

$H = 0\cdot147\ 2 + 0\cdot000\ 117\, m + 0\cdot000\ 001\ 5\, m^2$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1841·5	76·19	76·24	+0·05
1857·8	76·25	76·16	−0·09
1863·5	76·09	76·07	−0·02
1879·6	75·50	75·64	+0·14
1890·6	75·22	75·20	−0·02
1895·6	74·99	74·96	−0·03

Date.	Obs'd H.	Comp'd H.	C—O.
1857·8	0·1490	0·1482	−0·0008
1863·5	477	490	+ 13
1879·6	529	520	− 09
1890·6	540	545	+ 05
1895·6	0·1558	0·1557	−0·0001

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1840	+13·7	76·23	......	......
1850	14·48	76·23	0·1472	0·6184
1860	15·24	76·13	485	195
1870	15·92	75·93	501	174
1880	16·48	75·63	521	129
1890	16·89	75·23	543	0·6053
1900	+17·1	74·73	0·1569	0·5957

Secular variations of the magnetic declination, dip and intensity—Continued.

HALIFAX, NOVA SCOTIA.

$\varphi = 44° 39'.6 \qquad \lambda = 63° 35'.3$ W. of Gr.

[Naval yard observatory.]

No.	Date.	D.	References and remarks.
		° ′	
1	1604–1612	15¼ W.	Champlain, at Cape La Have.
2	1620, about	14 W.	R. Dudley's Arcano del Mare. C. & G. S. Rept. for 1888, App. No. 6.
3	1700—	13 W.	Edm. Halley's Tabula Nautica.
		12½ W.	Rough value deduced from contemporaneous ob's. C. & G. S. Bull. No. 6.
4	1750—	12 W.	Reference as above.
5	1756—	12 50 W.	C. Morris.
6	1775—	13 35 W.	Des Barres' sailing directions.
7	1798—	16½ W.	T. Backhouse, plan of Halifax.
8	1818 (?)	17 28 W.	J. Napier's remark book.
9	1821, June to Nov.	17 36 W.	Reference as above.
10	1833—	17½ W.	P. Barlow's isogonic chart.
11	1852, Aug.—1853, Aug.	18 46 W.	J. Hill, remark book.
12	1852–53.	18 51 W.	Capt. Bayfield, R. N.
13	1860, July 22.	19 55 W.	Capt. Orlebar, R. N.
14	1866, Apr. 1, 3.	21 05·6 W.	Halifax Dock Yard.
15	1873, May 15.	21 35 W.	H. M. S. Challenger. At drill ground, Dock Yard.
16	1879, Sept. 8, 10.	20 43·3 W.	J. B. Baylor, U. S. Coast and G. S. Report for 1881.
17	1890—	21 00 W.	Brit. Admy. Chart 311, with note: Mag'c Var'n nearly stationary.

$$D = +16°.18 + 4.53 \sin(1.0\, m + 46°.1)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1608·0	+16·25	½	+17·42	+1·17	1833·0	+17·50		+18·38	+0·88
1620·0	14·00	½	15·70	+1·70	1852·7	18·77		19·59	+0·82
1700·0	12·75	½	11·80	—0·95	1853·2	18·85		19·62	+0·77
1750·0	12·00	½	12·52	+0·52	1860·5	19·92		19·96	+0·04
1756·5	12·83		12·85	+0·02	1866·3	21·09		20·19	—0·90
1775·5	13·58		14·02	+0·44	1873·4	21·58		20·42	—1·16
1798·5	16·50		15·75	—0·75	1879·7	20·72		20·57	—0·15
1818·5	17·47		17·32	—0·15	1890·5	+21·00		+20·70	—0·30
1821·6	+17·60		+17·56	—0·04					

DIP AND INTENSITY AT HALIFAX.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1834, May 27.	75 33	0·1486	0·5966	Sir E. Home. Dock Yard Observatory.
2	1837, June 7.	74 58	0·1547		
3	1838·5.	74 45	......	......	Estcourt. Dock Yard Observatory.
4	1847·5.	75 37 (?)	0·1497	0·6026	G. W. Keely, U. S. Coast S. Dock Yard Observatory.
5	1873, May 13, 15, 16.	74 48·2	0·1561	0·5954	Macleer and Bromley, H. M. S. Challenger. Dock Yard drill ground.
6	1879, Sept. 8–10.	74 39·2	0·1592	0·6014	J. B. Baylor, U. S. Coast and G. S. Dock yard.
7	1881, Nov. 2.	74 29	0·1595	0·5962	Lieut. S. W. Very, U. S. N. Dock yard.

$$\Theta = 74°.92 - 0.007\,7\, m^{*}$$
$$H = 0.150\,1 + 0.000\,033\, m + 0.000\,008\,8\, m^2 \dagger$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1834·4	75·55	75·04	—0·51
1837·4	74·97	75·02	+0·05
1838·5	74·75	75·01	+0·26
1873·4	74·80	74·76	—0·04
1879·7	74·65	74·69	+0·04
1881·8	74·48	74·67	+0·19

Date.	Obs'd H.	Comp'd H.	C—O.
1835·9	0·1516	0·1514	—0·0002
1847·5	·1497	501	+ 4
1873·4	·1561	557	— 4
1879·7	·1592	0·1588	— 4
1881·8	0·1595	0·1600	+ 5

* An observation in 1896 demands $\Theta = 74°.94 - 0.016\,1\, m$ † An observation in 1896 demands $H = 0.151\,8 + 0.000\,130\, m + 0.000\,002\,85\, m^2$

Secular variations of the magnetic declination, dip and intensity—Continued.

HALIFAX, NOVA SCOTIA—Continued.

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+18·2	75·07	0·1529	0·5934
1840	18·9	75·00	06	819
1850	19·4	74·92	01	769
1860	19·9	74·84	13	785
1870	20·3	74·77	43	0·5873
1880	20·6	74·69	0·1590	0·6025
1890	20·7			
1900	+20·7			

BURLINGTON, VT.

$\varphi = 44^\circ\ 28'.7 \qquad \lambda = 73^\circ\ 12'.0$ W. of Gr.

[Burlington University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1793—	7 38 W.	Dr. Williams.
2	1805—	6 12 W.	J. Johnson.
3	1818—	7 30 W.	J. Johnson.
4	1822—	7 42 W.	J. Johnson.
5	1826—	7 36 W.	Prof. G. W. Benedict.
6	1830—	8 10 W.	J. Johnson.
7	1831—	8 15 W.	J. Johnson.
8	1832—	8 25 W.	J. Johnson.
9	1834—	8 50 W.	J. Johnson.
	1837—	9 45 W.	Prof. G. W. Benedict. Not used.
10	1840—	9 42 W.	J. Johnson.
11	1845, June 26.	9 22 W.	Dr. J. Locke.
12	1855, Aug. 28.	9 57·1 W.	C. A. Schott, U. S. Coast S. At encampment flagstaff near the lake shore.
13	1870, Nov. 12.	10 57 W.	G. A. Marr.
14	1873, Oct. 14, 15.	11 19·0 W.	Dr. T. C. Hilgard. At University station.
15	1890, Sept. 26, 27.	12 01·9 W.	J. B. Baylor, U. S. Coast and G. S. At University station.

$$D = +9^\circ.99 + 2.87 \sin(1.40\, m - 8^\circ.3)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1793·5	+7·63		+7·12	—0·51	1834·5	+ 8·83		+8·55	—0·28
1805·5	6·20	¼	7·28	+1·08	1840·5	9·70		8·94	—0·76
1818·5	7·50		7·72	+0·22	1845·5	9·37		9·27	—0·10
1822·5	7·70		7·90	+0·20	1855·7	9·95		9·98	+0·03
1826·5	7·60		8·10	+0·50	1870·9	10·95		11·02	+0·07
1830·5	8·17		8·32	+0·15	1873·8	11·32		11·20	—0·12
1831·5	8·25		8·38	+0·13	1890·7	+12·02	1½	+12·15	+0·13
1832·5	+8·42		+8·44	+0·02					

DIP AND INTENSITY AT BURLINGTON.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1845, June 26.	75 37·0	0·1564	0·6296	Dr. J. Locke.
2	1855, Aug. 28.	75 56·8	0·1579	0·6502	C. A. Schott, U. S. Coast S. At flagstaff north of city.
3	1873, Oct. 13, 14, 15.	75 24·2	0·1580	0·6271	Dr. T. C. Hilgard. Grounds of University.
4	1890, Sept. 26, 27, 28.	74 53·5	0·1604	0·6154	J. B. Baylor, U. S. Coast and G. S. Grounds of University.

Secular variations of the magnetic declination, dip and intensity—Continued.

BURLINGTON, VT.—Continued.

DIP AND INTENSITY AT BURLINGTON—Continued.

$$\Theta = 75^{\circ}.78 - 0.019\,1\,m$$
$$H = 0.156\,9 + 0.000\,078\,m$$

Date.	Obs'd Θ.	Comp'd Θ.	C — O.
	°	°	°
1845.5	75.62	75.87	+0.25
1855.7	75.95	75.67	—0.28
1873.8	75.40	75.33	—0.07
1890.7	74.89	75.00	+0.11

Date.	Obs'd H.	Comp'd H.	C — O.
1845.5	0.1564	0.1566	+0.0002
1855.7	0.1579	1573	— 6
1873.8	0.1580	1587	+ 7
1890.7	0.1604	0.1601	—0.0003

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1840	+ 8.90	75.97	0.1562	0.6443
1850	9.58	75.78	69	387
1860	10.27	75.59	77	336
1870	10.96	75.40	85	288
1880	11.58	75.21	0.1592	235
1890	12.11	75.02	0.1600	190
1900	+12.5	74.82	0.1608	0.6141

HANOVER, N. H.

$\varphi = 43^{\circ}\ 42'.3$ $\lambda = 72^{\circ}\ 17'.1$ W. of Gr.

[Dartmouth College Observatory.]

No.	Date.	D.	References and remarks.
		° ′	
1	1765—	7 W.	Pres. Wheelock.
2	1810—	4 15 W.	" "
3	1839—	9 15 W.	Prof. C. A. Young.
4	1855, Sept. 18.	10 27 W.	J. M. Clark.
5	1873, Oct. 4–11.	10 49.6 W.	Dr. T. C. Hilgard. Near observatory.
6	1876, Aug. 3, 5.	11 05.3 W.	F. E. Hilgard. At White River Junction.
7	{ 1879, Oct. 6.	10 50.5 W.	J. B. Baylor, U. S. Coast and G. S. Near observatory.
	{ 1879, Oct. 7.	11 38.4 W.	" " " " " " " " " ¾ mile west of observatory.
8	1890, Sept. 20, 22, 23.	11 57.2 W.	" " " " " " " " " " " "

$$D = +9^{\circ}.38 + 3.75 \sin (1.4\,m - 5^{\circ}.9)$$

Date.	Obs'd D.	p.	Comp'd D.	C — O.
	°		°	°
1765.5	+ 7.00		+ 6.28	—0.72
1810.5	4.25		6.09	+1.84
1839.5	9.25		8.06	—1.19
1855.7	10.45		9.52	—0.93
1873.7	10.83		11.10	+0.27
1876.6	11.09		11.33	+0.24
1879.8	11.64		11.57	—0.07
1890.7	+11.95	1½	+12.30	+0.35

Secular variations of the magnetic declination, dip and intensity—Continued.

HANOVER, N. H.—Continued.

DIP AND INTENSITY AT HANOVER.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1873, Oct. 4–10.	75 21·1	0·1593	0·6299	Dr. T. C. Hilgard. Near observatory.
2	1879, Oct. 6.	74 55·8	0·1604	0·6168	J. B. Baylor, U. S. Coast and G. S. Near observatory.
	1879, Oct. 7.	75 02·7	0·1601	0·6205	J. B. Baylor, U. S. Coast and G. S. ¼ mile west of observatory.
3	1890, Sept. 20, 21, 22.	74 43·4	0·1608	0·6104	J. B. Baylor, U. S. Coast and G. S. ¼ mile west of observatory.

PORTLAND, ME.

$\varphi = 43° \, 38'·8 \qquad \lambda = 70° \, 16'·6$ W. of Gr.

[Bramhall Hill.]

No.	Date.	D.	References and remarks.
		° ′	
	1604–1612.	19 12 W.	Champlain, at the mouth of the Kennebec River. Not used.
	1620, about.	12½ W.	R. Dudley's Arcano del Mare.
1	1700—	12·4 W.	Edm. Halley's Tabula Nautica.
		11·8 W.	C. and G. S. Rept. for 1888, p. 306. Value deduced from obs'ns at 19 stations.
2	1750—	9·2 W.	C. and G. S. Rept. for 1888, p. 308. Value deduced from obs'ns at 17 stations.
3	1763—	7 45 W.	Prof. J. Winthrop at Falmouth.
4	1775—	8 30 W.	Des Barres' Atlantic Neptune.
5	1833—	10 W.	P. Barlow's isogonic chart.
6	1845, June 4.	11 28·3 W.	Dr. J. Locke.
7	1851, Aug. 18, 20.	11 41·1 W.	J. E. Hilgard, U. S. Coast Survey. At Bramhall Hill.
8	1859, July 15.	12 20 W.	C. A. Schott, U. S. Coast S. At Bramhall Hill.
	1863, July 6.	12 18·1 W.	C. A. Schott, U. S. Coast S. At Munjoy Observatory. Not used.
9	1863, July 15.	12 28·2 W.	C. A. Schott, U. S. Coast S. At Bramhall Hill.
10	1864, Aug. to Dec.	12 43·7 W.	Prof. H. W. Richardson, U. S. Coast S. At Bramhall Hill.
11	1865, Jan. to Dec.	12 42·3 W.	Prof. H. W. Richardson, U. S. Coast S. At Bramhall Hill.
12	1866, Jan. to Mar., incl.	12 42·9 W.	Prof. H. W. Richardson, U. S. Coast S. At Bramhall Hill.
13	1873, Sept. 8, 9, 11.	12 43·6 W.	Dr. T. C. Hilgard. At Munjoy Observatory. Red'n to B. Hill + 10′.
14	1887, Oct. 14, 15.	13 51·0 W.	J. B. Baylor U. S. Coast and G. S. At Bramhall Hill.
15	1895, July 26, 27.	14 16·2 W.	" " " " " " " " " " " "

$$D = +11°·40 + 3·28 \sin (1·30\, m + 2°·7)$$

Date.	Obs'd D.	p.	Comp'd D.	C — O.	Date.	Obs'd D.	p.	Comp'd D.	C — O.
	°		°	°		°		°	°
1700·0	+12·10		+12·16	+0·06	1863·5	+12·47		+12·59	+0·12
1750·0	9·20		8·85	—0·35	1864·8	12·73		12·70	—0·03
1763·5	7·75		8·37	+0·62	1865·5	12·71		12·74	+0·03
1775·5	8·50		8·19	—0·31	1866·1	12·72		13·77	+0·05
1833·0	10·00		10·31	+0·31	1873·7	12·89		13·27	+0·38
1845·4	11·47		11·27	—0·20	1887·8	13·85		14·04	+0·19
1851·6	11·69		11·74	+0·05	1895·6	+14·27		+14·30	+0·03
1859·5	+12·33		+12·31	—0·02					

Secular variations of the magnetic declination, dip and intensity—Continued.

PORTLAND, ME.—Continued.

DIP AND INTENSITY AT PORTLAND.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1845, June 2.	75 13·7	0·1580	0·6197	Dr. J. Locke.
2	1851, Aug. 15, 20.	75 14·1	0·1591	0·6242	J. E. Hilgard, U. S. Coast S. On Bramhall Hill.
3	1859, July 15.	74 56·7	0·1593	0·6137	C. A. Schott, U. S. Coast S. On Bramhall Hill.
4	{ 1863, July 6.	75 04·6	0·1577	0·6123	" " " " " " " " Munjoy "
	{ 1863, July 15.	75 05·9	0·1583	0·6156	" " " " " " " "
5	1864, Aug. to Dec.	75 09·5	0·1593	0·6220	Prof. H. W. Richardson. At Bramhall Hill Magnetic Observatory.
6	1865, Jan. to Dec.	75 08·3	0·1595	0·6219	" " " "
7	1866, Jan. to Mar.	75 07·4	0·1593	0·6210	" " " "
8	1873, Sept. 8, 11.	74 57·9	0·1601	0·6171	Dr. T. C. Hilgard. On Munjoy Hill.
9	1887, Oct. 14, 15.	74 30·0	0·1628	0·6095	J. B. Baylor, U. S. Coast and G. S. On Bramhall Hill.
10	1895, July 26, 27.	74 04·6	0·1664	0·6065	J. B. Baylor, U. S. Coast and G. S. On Bramhall Hill.

$$\Theta = 75^\circ{\cdot}21 + 0{\cdot}001\ 1\ m - 0{\cdot}000\ 548\ m^2$$
$$H = 0{\cdot}158\ 5 - 0{\cdot}000\ 017\ m + 0{\cdot}000\ 004\ 0\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1845·4	75·23	75·20	—0·03
1851·6	75·24	·21	— ·03
1859·5	74·95	·17	+ ·22
1863·5	75·09	·12	+ ·03
1864·8	75·16	·11	— ·05
1865·5	75·14	·09	— ·05
1866·1	75·12	75·09	— ·03
1873·7	74·96	74·93	— ·03
1887·8	74·50	74·47	— ·03
1895·6	74·08	74·12	+ 0·04

Date.	Obs'd H.	Comp'd H.	C—O.
1845·4	0·1580	0·1586	+0·0006
1851·6	·1591	585	— 06
1859·5	·1593	587	— 06
1863·5	·1580	590	+ 10
1864·8	·1593	591	— 02
1865·5	·1595	592	— 03
1866·1	·1593	·1592	— 01
1873·7	·1601	·1603	+ 02
1887·8	·1628	·1635	+ 07
1895·6	0·1664	0·1659	—0·0005

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1840	+10·82	75·15	0·1591	0·6208
1850	11·56	75·21	·1585	209
1860	12·29	75·17	·1587	200
1870	12·97	75·01	·1597	176
1880	13·58	74·75	·1616	144
1890	14·08	74·38	·1642	098
1900	+14·4	73·90	0·1675	0·6040

RUTLAND, VT.

$\varphi = 43^\circ\ 36'{\cdot}2$ $\lambda = 72^\circ\ 55'{\cdot}0$ W. of Gr.

[City Park.]

No.	Date.	D.	References and remarks.
		° ′	
1	1789, Apr.	7 03 W.	Dr. Williams.
2	1810, May.	6 04 W.	"
3	1811, Sept.	6 01 W.	"
4	1859, July 21.	9 49 W.	C. A. Schott, U. S. Coast S. Near post-office.
5	1873, Oct. 17, 18.	10 40·2 W.	Dr. T. C. Hilgard. Near post-office.
6	1879, Oct. 14, 15.	11 09·0 W.	J. B. Baylor, U. S. Coast & G. S. Near post-office.
7	1890, Oct. 1, 2.	11 32·6 W.	J. B. Baylor, U. S. Coast & G. S. In city park.

Secular variations of the magnetic declination, dip and intensity—Continued.

RUTLAND, VT.—Continued.

$$D = +9^\circ.80 + 3.44 \sin (1.42\, m - 21^\circ.3).$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1789·3	+ 7·05		+6·52	—0·53
1810·4	6·07		6·44	+0·37
1811·7	6·02		6·47	+0·45
1859·6	9·82		9·34	—0·48
1873·8	10·67		10·54	—0·13
1879·8	11·15		11·03	—0·12
1890·7	+11·54	1½	+11·85	+0·31

DIP AND INTENSITY AT RUTLAND.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1859, July 21.	75 19·8	0·1597	0·6308	C. A. Schott, U. S. Coast S. Near post-office.
2	1873, Oct. 16, 17, 18.	75 05·1	0·1610	0·6257	Dr. T. C. Hilgard. Near post-office.
3	1879, Oct. 14, 15.	74 49·5	0·1637	0·6253	J. B. Baylor, U. S. Coast & G. S. Near post-office.
4	1890, Oct. 1, 2.	74 21·5	0·1638	0·6076	J. B. Baylor, U. Coast & G. S. In city park.

$$\Theta = 75^\circ.70 - 0.031\ 0\ m$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1859·5	75·33	75·41	+0·08
1873·8	75·08	74·96	—0·12
1879·8	74·82	74·78	—0·04
1890·7	74·36	74·44	+0·08

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1850	+ 8·55	75·70
1860	9·38	75·39
1870	10·22	75·08
1880	11·05	74·77
1890	11·80	74·46
1900	+12·4	74·15

PORTSMOUTH, N. H.

$\varphi = 43^\circ\ 04'.3$ $\lambda = 70^\circ\ 42'.5$ W. of Gr.

[Newcastle Light-House.]

No.	Date.	D.	References and remarks.
		° ′	
1	1771—	7 46 W.	Holland.
2	1775—	7 45 W.	Des Barres' Atlantic Neptune.
3	1833—	8 45 W.	P. Barlow's isogonic chart.
4	1844-45.	9 47 W.	Maj. J. D. Graham, U. S. E. At Boiling Rock.
5	1850, Aug. 28, Sept. 2.	10 30·2 W.	J. E. Hilgard, U. S. Coast S. At Kittery Point, Me.
6	1859, July 14.	11 15·0 W.	C. A. Schott, " " " " " " " "
7	1879, Aug. 13, 14.	12 31·3 W.	J. B. Baylor, U. S. Coast & G. S. At Kittery Point, Me.
8	1890, Aug. 28, 29.	12 44·3 W.	" " " " " " " " " " " " " "

***Secular variations of the magnetic declination, dip and intensity*—Continued.**

PORTSMOUTH, N. H.—Continued.

$D = +10°.55 + 3.08 \sin(1.4\,m - 5°.1)$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1771.5	+ 7.77		+ 7.76	—0.01
1775.5	7.75		7.65	—0.10
1833.0	8.75		9.06	+0.31
1845.0	9.78		9.90	+0.12
1850.7	10.50		10.33	—0.17
1859.5	11.25		10.99	—0.26
1879.6	12.52		12.37	—0.15
1890.7	+12.74		+12.97	+0.23

DIP AND INTENSITY AT PORTSMOUTH.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1850, Aug. 29, Sept. 4.	74 57.2	0.1614	0.6216	J. E. Hilgard, U. S. Coast S. At Kittery Point, Me.
2	1859, July 14.	75 04.2	0.1612	0.6257	C. A. Schott, U. S. Coast S. At Kittery Point, Me.
3	1879, Aug. 13, 14.	74 26.2	0.1654	0.6166	J. B. Baylor, U. S. Coast & G. S. At Kittery Point, Me.
4	1890, Aug. 28, 29.	74 04.5	0.1657	0.6040	J. B. Baylor, U. S. Coast & G. S. At Kittery Point, Me.

$\Theta = 75°.12 - 0.024\,0\,m.$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1850.7	74.95	75.10	+0.15
1859.5	75.07	74.89	—0.18
1879.6	74.44	74.41	—0.03
1890.6	74.08	74.15	+0.07

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1850	+10.28	75.12
1860	11.03	74.88
1870	11.75	74.64
1880	12.40	74.40
1890	12.94	74.16
1900	+13.3	73.92

CHESTERFIELD, N. H.

$\varphi = 42°\ 53'.5 \qquad \lambda = 72°\ 24'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1813.0	6 25 W.	Nathan Wilde. The original series has been changed from annual to biennial values by taking means of consecutive years.
2	1815.0	6 12 W.	
3	1817.0	6 03 W.	
4	1819.0	6 02 W.	
5	1821.0	6 04 W.	
6	1823.0	6 21 W.	
7	1825.0	6 37 W.	
8	1827.0	6 40 W.	
9	1829.0	6 56 W.	
10	1831.0	7 08 W.	
11	1833.0	7 22 W.	
12	1835.0	7 37 W.	
13	1837.0	7 55 W.	A. C. Twining.
14	1874, Oct. 4.	10 26.6 W.	Dr. T. C. Hilgard. One mile east of Factory Village.
15	1890, Sept. 14, 16.	11 12.7 W.	J. B. Baylor, U. S. Coast & G. S. One mile east of Factory Village (1874 station).

Secular variations of the magnetic declination, dip and intensity—Continued.

CHESTERFIELD, N. H.—Continued.

$$D = +8^\circ{\cdot}67 + 3{\cdot}22 \sin(1{\cdot}45\, m - 1^\circ{\cdot}9) + 0{\cdot}21 \sin(9\, m + 168^\circ)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1813·0	+6·42		+5·96	—0·46	1829·0	+ 6·93		+ 6·87	—0·06
1815·0	6·20		5·99	—0·21	1831·0	7·13		7·07	—0·06
1817·0	6·05		6·05	0·00	1833·0	7·37		7·29	—0·08
1819·0	6·03		6·12	+0·09	1835·0	7·62		7·50	—0·12
1821·0	6·07		6·22	+0·15	1837·0	7·92		7·69	—0·23
1823·0	6·35		6·35	0·00	1874·7	10·45		10·57	+0·12
1825·0	6·62		6·51	—0·11	1890·7	+11·22		+11·39	+0·17
1827·0	+6·67		+6·68	+0·01					

DIP AND INTENSITY AT CHESTERFIELD.

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1874, Oct. 4.	74	24·7	0·1659	0·6175	Dr. T. C. Hilgard. One mile east of Factory Village.
2	1890, Sept. 14, 16.	73	54·7	0·1677	0·6051	J. B. Baylor, U. S. Coast & G. S. One mile east of Factory Village.

NEWBURYPORT, MASS.

$\varphi = 42^\circ\ 48'{\cdot}9 \qquad \lambda = 70^\circ\ 49'{\cdot}2$ W. of Gr.

No.	Date.	D.		References and remarks.
		°	′	
1	1750—	8	14 W.	C. & G. S. Rept. for 1888, p. 306, deduced from obs'ns at 17 stations.
2	1775—	6	45 W.	Des Barres' Atlantic Neptune.
3	1781—	7	18 W.	Dr. Williams.
4	1833—	8½		P. Barlow's isogonic chart.
5	1850, Sept. 18, 19, 20.	10	06 W.	J. E. Hilgard, U. S. Coast S. On Plum Island.
6	1859, July 13.	10	58 W.	C. A. Schott, " " " " " " "
7	1887, Oct. 19, 20.	12	12 W.	J. B. Baylor, U. S. Coast & G. S. " " "

$$D = +10^\circ{\cdot}07 + 3{\cdot}02 \sin(1{\cdot}35\, m - 1^\circ{\cdot}0)$$

Date.	Obs'd D.	p.	Comp'd.	C—O.
	°		°	°
1750·0	+ 8·23	½	+ 7·97	—0·26
1775·5	6·75		7·11	+0·36
1781·5	7·30		7·06	—0·24
1833·0	8·50	½	8·84	+0·34
1850·7	10·09		10·07	—0·02
1859·5	10·97		10·69	—0·28
1887·8	+12·20		+12·38	+0·18

DIP AND INTENSITY AT NEWBURYPORT.

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1850, Sept. 18, 19.	74	54·9	0·1628	0·6254	J. E. Hilgard, U. S. Coast S. On Plum Island.
2	1859, July 13.	74	52·9	0·1627	0·6238	C. A. Schott, " " " " " " "
3	1887, Oct. 19, 20.	74	01·1	0·1662	0·6038	J. B. Baylor, " " " & G. S. " " "

Secular variations of the magnetic declination, dip and intensity—Continued.

WILLIAMSTOWN, MASS.

$\varphi = 42° \ 42'.8 \qquad \lambda = 73° \ 13'.4$ W. of Gr.

[Astronomic observatory.]

No.	Date.	D.	References and remarks.
		° ′	
1	1750—	7 32 W.	C. & G. Survey Bulletin, No. 6.
2	1786—	5 52 W.	Dr. Williams.
3	1833—	6 15 W.	Prof. A. Hopkins.
4	1837—	7 45 W.	" " "
5	1876, July 28, 29.	10 31 W.	F. E. Hilgard. At North Adams.
6	1886, Aug. 22.	10 21 W.	A. Walker and Prof. T. H. Safford. Williams College Meridian.

$$D = +8°.84 + 3.13 \sin (1.4\, m - 14°.0)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1750.0	+ 7.53		+ 7.47	—0.06
1786.5	5.87		5.79	—0.08
1833.0	6.25		6.95	+0.70
1837.5	7.75		7.21	—0.54
1876.6	10.52		10.07	—0.45
1886.6	+10.35		+10.73	+0.38

DIP AND INTENSITY AT WILLIAMSTOWN, MASS.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1876, July 28, 29.	74 15.3	0.1710	0.6302	F. E. Hilgard. At North Adams.

ALBANY, N. Y.

$\varphi = 42° \ 39'.2 \qquad \lambda = 73° \ 45'.8$ W. of Gr.

[State capitol.]

No.	Date.	D.	References and remarks.
		° ′	
	1580—	10½ W.	De Isogonen in the XVI en XVII Eeuw., proefschrift door W. Van Bemelen, Utrecht, 1893. Not used.
1	1609, Sept. 13.	13 W.	Robert Juet, sailing master of Hendrick Hudson's ship, the Half Moon, on tide water of upper Hudson. Communicated by Verplanck Colvin, 1893.
	1610—	12 W.	De Isogonen, etc., W. Van Bemelen, 1893. Not used.
2	1625 about	12.2 W.	R. Dudley's Arcano del Mare. App. No. 6, C. & G. S. Rep. for 1888.
	1640—	11 W.	W. Van Bemelen's isogonic charts. Not used.
	1665—	12 W.	
	1680—	12 W.	
3	1686—	9 09 W.	Van Rensselaer's patent.
	1686—	10 33 W.	From a parchment map in City Engineer's Office, bearing date of Jan., 1773, and referring to the charter of the city. Communicated by Horace Andrews, city engineer, 1891. Weighted mean used in the discussion.
4	1712—	9 14 W.	Reference as for No. 3. (Horace Andrews, 1891.)
5	1735—	7 40 W.	From notes by J. R. Bleeker, surveyor. Communicated by Verplanck Colvin, 1893.
6	1764—	6 46 W.	From a parchment map in City Engineer's Office, bearing date of Nov. 29, 1800, and referring to boundary lines of the city. Signed by Simeon De Witt and John E. Van Alen. Communicated by H. Andrews, 1891.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

ALBANY, N. Y.—Continued.

No.	Date.	D.	References and remarks.
		° ′	
7	1766—	6 24 W.	From a parchment map in City Engineer's Office, bearing date of Jan., 1773. Signed by J. Van Rensselaer. Communicated by H. Andrews, 1891.
8	1768—	6 39 W.	From notes by J. R. Bleeker, surveyor.
9	1787—	5 03 W.	Records of Livingstone Manor; referred to Albany, 5° 34′. } Communicated by Verplanck Colvin, Jan. 23, 1893.
10	1789—	5 27 W.	New York Documentary History.
11	1798, Apr. (?).	5 00 W.	Note from Prof. Joseph Henry, deduced from obser's of 1825.
12	1805, July 30.	4 58 W.	Simeon De Witt, Surveyor-General.
13	1807, Sept. 4.	5 43 W.	" " " " "
14	1817, Oct. 4.	5 44 W.	} " " " " "
15	1818, Aug. 1.	5 45 W.	
16	1825, Apr. 24.	6 00 W.	
17	1828, Sept.	6 14 W.	} Geological Report, State of New York.
	1828, Sept. 20.	6 16 W.	
	1828, Sept. 22.	6 18 W.	
18	1830, June.	6 18 W.	
19	1831, May 5.	6 25 W.	
	1831, May.	6 32 W.	
	1831, Nov. 5.	6 40 W.	Regent's Report.
20	1833, Nov.	6 40 W.	" " Communicated by Verplanck Colvin, 1893.
21	1834, Oct. 1.	6 40 W.	} " "
22	1836, Oct. 29.	6 47 W.	
23	1847, Nov.	7 35 W.	
24	1855, Aug. 31.	7 54·7 W.	C. A. Schott, U. S. Coast Survey. At Greenbush, opposite Albany.
25	1856, Sept 1.	8 39·2 W.	K. Friesach; corrected for diurnal variation 8° 35′.
26	1858, May 12, 13, 14.	8 17·0 W.	G. W. Dean, U. S. Coast S. At Dudley Observatory. (Old location.)
27	1874, July 25.	9 09 W.	Verplanck Colvin. At his residence in $\varphi=42° 39'·7$, $\lambda=73° 46'·6$.
28	1879, Oct. 21, 24.	9 51·7 W.	J. B. Baylor, U. S. Coast & G. S. At Dudley Observatory station of 1858.
29	1880, Apr. 10.	10 14 W.	} Verplanck Colvin. At his residence between Western avenue and State street; position as above (1874). The station is marked by a brownstone monument. Communicated Jan. 23, 1893.
30	1881, Apr. 30.	10 20 W.	
31	1882, Apr.	10 12 W.	
32	1883, June.	10 17 W.	
33	1884, June 3.	10 24 W.	
34	1885, May 22.	10 13 W.	
35	1886, June 5.	10 16 W.	
36	1887, June 28.	10 21 W.	
37	1888, Apr. 25.	10 24 W.	
38	1889, May.	10 23 W.	
39	1890, July 19.	10 22 W.	
	1890, Oct. 7, 8.	10 10·1 W.	J. B. Baylor, U. S. Coast & G. S. Dudley Observatory station as in 1879 and 1858. Mean value used.
40	1891, Feb. 3.	10 30 W.	} Verplanck Colvin, at his residence, as before.
41	1892, Nov. 22.	10 37 W.	

Secular variations of the magnetic declination, dip and intensity—Continued.

ALBANY, N. Y.—Continued.

$D = +8^\circ{\cdot}76 + 3{\cdot}33 \sin(1{\cdot}25\, m - 18^\circ{\cdot}0)$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1609·7	+13·00	¾	+10·97	—2·03	1836·8	+ 6·78		+ 6·87	+0·09
1625·0	12·20		11·73	—0·47	1847·9	7·58		7·59	+0·01
1686·5	10·08		11·00	+0·92	1855·7	7·91		8·13	+0·22
1712·5	9·23		9·33	+0·10	1856·7	8·58		8·20	—0·38
1735·5	7·67		7·68	+0·01	1858·4	8·28		8·32	+0·04
1764·5	6·77		6·03	—0·74	1874·6	9·14		9·50	+0·36
1766·5	6·40		5·95	—0·45	1879·6	9·86		9·85	—0·01
1768·5	6·65		5·87	—0·78	1880·3	10·23		9·89	—0·34
1787·5	5·57		5·45	—0·12	1881·3	10·33		9·96	—0·37
1789·5	5·45		5·44	—0·01	1882·3	10·20		10·03	—0·17
1798·3	5·00		5·46	+0·46	1883·5	10·28		10·11	—0·17
1805·6	4·97		5·57	+0·60	1884·4	10·40		10·17	—0·23
1807·7	5·72		5·61	—0·11	1885·4	10·21		10·23	+0·02
1817·8	5·73		5·93	+0·20	1886·4	10·27		10·30	+0·03
1818·6	5·75		5·96	+0·21	1887·5	10·36		10·37	+0·01
1825·3	6·00		6·25	+0·25	1888·3	10·41		10·42	+0·01
1828·6	6·27		6·41	+0·14	1889·4	10·38		10·48	+0·10
1830·5	6·30		6·52	+0·22	1890·7	10·27		10·57	+0·30
1831·6	6·54		6·58	+0·04	1891·1	10·50		10·59	+0·09
1833·9	6·67		6·71	+0·04	1892·9	+10·62		+10·70	+0·08
1834·8	+ 6·67		+ 6·76	+0·09	(*)				

The diagram on Plate A shows the observed and computed declinations, the latter by the S-shaped curve; apparently the horizontal needle has moved through a complete cycle of about two hundred and eighty-eight years.

DIP AND INTENSITY AT ALBANY.

No.	Date.	Θ	H.	F.	References.
		° ′			
1	1833, Apr.	74 51·1	......	......	Prof. J. Henry and Capt. T. J. Cram.
2	1834, Aug.	74 40·1	......	......	Dr. A. D. Bache.
3	1835—	....	0·1650	0·6238	" " " " and Prof. E. H. Courtenay.
4	1839, Sept.	74 51·3	......	......	Prof. E. Loomis.
5	1841, Aug.	74 39·9	......	......	Prof. J. N. Nicollet.
	1841—	74 40·1	......	......	Dr. A. D. Bache.
6	1842, Oct. 21.	74 44·6	0·1651	0·6275	Sir J. H. Lefroy.
7	1844, June 14.	74 40·2	0·1652	0·6248	Dr. J. Locke. At Albany.
	1844, June 14.	74 43·1	0·1650	0·6261	" " " At Greenbush.
8	1855, Aug. 31.	75 11·1	0·1654	0·6469	C. A. Schott, U. S. Coast S. At Greenbush.
9	1856, Sept.	74 56	0·1678 (?) 48	0·6455	K. Friesach.
10	1858, May 13–19.	74 55·6	0·1653	0·6357	G. W. Dean, U. S. Coast S. At Dudley Observatory.
11	1879, Oct. 21–24.	74 18·9	0·1681	0·6217	J. B. Baylor, U. S. Coast & G. S. At Dudley Observatory.
12	1890, Oct. 7, 8, 9.	74 01·0	0·1677	0·6091	J. B. Baylor, U. S. Coast & G. S. At Dudley Observatory.

* An observation in 1896 makes C — O = zero.

Secular variations of the magnetic declination, dip and intensity—Continued.

ALBANY, N. Y.—Continued.

DIP AND INTENSITY AT ALBANY—Continued.

$$\Theta = 74^\circ{\cdot}91 + 0{\cdot}003\,7\,m - 0{\cdot}000\,653\,m^2$$
$$H = 0{\cdot}165\,2 + 0{\cdot}000\,033\,m + 0{\cdot}000\,001\,0\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1833·3	74·85	74·67	—0·18
1834·6	74·67	74·70	+0·03
1839·7	74·86	74·80	—0·06
1841·5	74·67	74·83	+0·16
1842·8	74·74	74·85	+0·11
1844·4	74·69	74·87	+0·18
1855·7	75·18	74·91	—0·27
1856·7	74·93	74·91	—0·02
1858·4	74·93	74·90	—0·03
1879·8	74·32	74·44	+0·12
1890·8	74·02	73·98	—0·04

Date.	Obs'd H.	Comp'd H.	C—O.
1835·5	0·1650	0·1649	—0·0001
1842·8	50	50	00
1844·4	51	50	— 01
1855·7	54	54	00
1856·7	48	54	+ 06
1858·4	53	55	+ 02
1879·8	81	71	— 10
1890·8	0·1677	0·1683	+0·0006

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+ 6·49	74·57	0·1650	0·6201
1840	7·07	74·81	50	297
1850	7·73	74·91	52	345
1860	8·44	74·88	56	349
1870	9·17	74·72	62	306
1880	9·87	74·43	71	226
1890	10·52	74·01	82	0·6106
1900	+11·1	73·46	0·1695	0·5954

SALEM, MASS.

$\varphi = 42^\circ\ 31'{\cdot}9$ $\lambda = 70^\circ\ 52'{\cdot}5$ W. of Gr.

[Fort Lee.]

No.	Date.	D.	References and remarks.
		° ′	
1	1750—	7 53 W.	U. S. Coast & G. S. Bulletin No. 6.
2	1781, Aug.	7 02 W.	Pres. Willard. At Beverly, reduction to Salem — 8′.
3	1805, Nov.	5 57 W.	Dr. N. Bowditch. At Salem.
4	1808, June.	5 20 W.	" " " Near Salem.
5	{ 1810, Apr.	5 31 W.	} " " " " " Mean 5° 57′ W.
	{ 1810, Apr., to 1811, May.	6 23 W.	
6	1833—	8½ W.	P. Barlow's isogonic chart.
7	1849, Aug. 20.	10 14·5 W.	Prof. G. W. Keely. At Fort Lee.
8	1855, Aug. 25.	10 49·7 W.	C. A. Schott, U. S. Coast S. At Fort Lee.
9	1877·5.	11½ W.	I. K. Harris.
10	1887, Oct. 22, 23.	12 38·1 W.	J. B. Baylor, U. S. Coast & G. S. At Fort Lee.

Secular variations of the magnetic declination, dip and intensity—Continued.

SALEM, MASS.—Continued.

$$D = +9^\circ.98 + 3.85 \sin (1.4\, m - 5^\circ.1)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1750·0	+ 7·89	½	+ 7·78	—0·11
1781·6	6·90		6·20	—0·70
1805·8	5·95		6·44	+0·49
1808·5	5·33	¼	6·54	+1·21
1810·8	5·95		6·65	+0·70
1833·0	8·50	½	8·12	—0·38
1849·6	10·23		9·60	—0·63
1855·6	10·83		10·16	—0·67
1877·5	11·50		12·10	+0·60
1887·8	+12·63		+12·83	+0·20

DIP AND INTENSITY AT SALEM.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1849, Aug. 18.	....	0·1608	......	Prof. G. W. Keely. At Fort Lee.
2	1855, Aug. 25.	75 36·9	0·1609	0·6474	C. A. Schott, U. S. Coast S. At Fort Lee.
3	1887, Oct. 22, 23.	74 24·8	0·1631	0·6070	J. B. Baylor, U. S. Coast & G. S. At Fort Lee.

OXFORD, N. Y.

$\varphi = 42^\circ\ 26'.5$ $\lambda = 75^\circ\ 40'.5$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1792–1895.	3 W.	E. B. McCall.
2	1817—	3 W.	
3	1828, July 7.	4½ W.	
4	1834, Oct. 9.	3 52 W.	Regent's report.
5	1836, Oct. 5.	4 09 W.	
6	1837—	4 30 W.	
7	1838, July 6.	4 30 W.	At Guilford; 4° 27′ when reduced to Oxford.
8	1849, Nov. 27.	5 11 W.	E. B. McCall.
9	1857, Apr. 4.	5 44 W.	
10	1858, Feb. 4.	5 47 W.	
11	1858, Dec.	5 50 W.	
12	1873, Dec. 1.	6 52 W.	E. Taintor.
13	1874, May 29 to June 6.	6 55·7 W.	Dr. T. C. Hilgard. About ¼ mile north of R. R. depot.
14	1885, Sept. 23, 24, 25.	7 43·3 W.	J. B. Baylor, U. S. Coast & G. Survey.

$$D = +6^\circ.19 + 3.24 \sin (1.35\, m - 18^\circ.9)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1794·0	+3·00		+2·96	—0·04	1849·9	+5·18		+5·14	—0·04
1817·5	3·00		3·31	+0·31	1857·3	5·73		5·68	—0·05
1828·5	4·50	½	3·79	—0·71	1858·1	5·78		5·74	—0·04
1834·8	3·87		4·13	+0·26	1859·0	5·83		5·81	—0·02
1836·8	4·15		4·26	+0·11	1873·9	6·87		6·94	0·07
1837·5	4·50		4·30	—0·20	1874·4	6·93		6·97	+0·04
1838·5	+4·45		+4·36	—0·09	1885·7	7·72		+7·77	+0·05

Secular variations of the magnetic declination, dip and intensity—Continued.

OXFORD, N. Y.—Continued.

DIP AND INTENSITY AT OXFORD.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1874, June 4.	74 05·8	0·1718	0·6270	Dr. T. C. Hilgard. ¼ mile N. of R. R. Depot.
2	1885, Sept. 23, 24, 25.	73 45·8	0·1715(?) / 0·1689	0·6128(?) / 0·6036	J. B. Baylor, U. S. Coast & G. S. ¼ mile N. of R. R. Depot. Lower value of H. and F. preferred.

CAMBRIDGE, MASS.

$\varphi = 42^\circ\ 22'{\cdot}9 \qquad \lambda = 71^\circ\ 07'{\cdot}7$

[Harvard College Observatory.]

No.	Date.	D.	References and remarks.
		° ′	
1	1708—	9 W.	Brattle.
2	1742—	8 W.	Prof. J. Winthrop's table.
3	1750—	7·8 W.	C. & G. S. Rept. for 1888, p. 308, deduced from observations at 19 stations.
4	1757—	7 20 W.	Prof. J. Winthrop's table.
5	1761—	7 14 W.	Dr. Williams.
6	1763—	7 00 W.	Prof. J. Winthrop.
7	1780—	7 02 W.	Dr. Williams.
8	1782—	6 44 W.	Dr. Williams and Prof. Sewall.
9	1783—	6 52 W.	Dr. Williams.
10	1788—	6 38 W.	
11	1810—	7 30 W.	Prof. Farrar.
	1833—	8 W.	P. Barlow's isogonic chart. Not used.
12	1835—	8 51 W.	Prof. Farrar.
13	1837—	9 09 W.	Mem. Amer. Acad.
14	1840·4	9 18 W.	W. C. Bond.
15	1842·2	9 35 W.	Prof. J. Lovering.
16	1844—	9 39 W.	W. C. Bond, Harvard Observatory.
17	1845, June 2.	9 32 W.	Dr. J. Locke, Harvard Observatory.
18	1850, Aug. 9.	9 30 W.	Lieut. J. C. Ives, Harvard Observatory.
19	1852—	10 08 W.	W. C. Bond, Harvard Observatory.
20	1854—	10 39 W.	
	1854, May 10.	9 46 W.	Lieut. J. C. Ives, Harvard Observatory.
21	1855, May 22, 23.	10 54·6 W.	W. C. Bond, Harvard Observatory.
22	1856, May 16.	10 50·3 W.	
	1856, July 17.	10 06 W.	K. Friesach, Harvard Observatory.
23	1859, Mar.	10 48 W.	Lieut. W. P. Smith, Harvard Observatory.
24	1866–67–68.	10 41 W.	Prof. J. Winlock, Harvard Observatory.
25	1879, Aug. 7, 9.	11 46·3 W.	J. B. Baylor, U. S. Coast & G. S., Harvard Observatory.
26	1895, July 17, 19.	12 22·3 W.	" " " " " " " " " Grounds of Harvard Observatory.

$$D = +9^\circ{\cdot}68 + 2{\cdot}81 \sin\left(1{\cdot}32\, m + 5^\circ{\cdot}9\right)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1708·5	+9·00		+9·72	+0·72	1840·4	+ 9·30		+ 9·35	+0·05
1742·5	8·00		7·73	—0·27	1842·2	9·57		9·46	—0·11
1750·0	7·80		7·41	—0·39	1844·5	9·65		9·61	—0·04
1757·5	7·33		7·16	—0·17	1845·4	9·53		9·67	+0·14
1761·5	7·23		7·06	—0·17	1850·6	9·50		10·01	+0·51
1763·5	7·00		7·01	+0·01	1852·5	10·13		10·13	0·00
1780·5	7·03		6·87	—0·16	1854·5	10·21		10·25	+0·04
1782·5	6·75		6·88	+0·13	1855·4	10·91		10·31	—0·60
1783·5	6·87		6·90	+0·03	1856·5	10·47		10·38	—0·09
1788·5	6·63		6·96	+0·33	1859·2	10·80		10·55	—0·25
1810·5	7·50		7·65	+0·15	1867·5	10·70		11·04	+0·34
1835·5	8·85		9·04	+0·19	1879·6	11·77		11·67	—0·10
1837·5	+9·15		+9·16	+0·01	1895·5	+12·37	2	+12·25	—0·12

Secular variations of the magnetic declination, dip and intensity—Continued.

CAMBRIDGE, MASS.—Continued.

DIP AND INTENSITY AT CAMBRIDGE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1722 ⅔	68 22	......	......	Capt. Othniel Beal, Boston Harbor. W. Whiston's "The calculation of solar eclipses, etc., with an account of some late observations made with the dipping needles, etc." Cited by Dr. L. A. Bauer, p. 33 of his inaugural dissertation "Beiträge zur Kentniss der Secular-Variation des Erdmagnetismus." Berlin, 1895.
2	1780, Dec. 25.	69 51	......	......	Dr. Williams.
3	1782, June 2.	69 41	......	......	
4	1783, Dec. 23.	69 41	......	......	
5	1839, Sept.	74 20·1	......	......	Prof. E. Loomis.
6	1840—	74 21·6	......	......	Prof. J. Lovering and W. C. Bond.
7	1841, June.	74 17·3	......	......	Maj. J. D. Graham and W. C. Bond.
8	1842—	74 19·5	0·1677	0·6205	Sir J. H. Lefroy. Grounds of Harvard Observatory.
	1842-	74 17·8	......	......	Maj. J. D. Graham. Grounds of Harvard Observatory.
	1842, May 4.	74 14·9	0·1688	0·6219	Dr. J. Locke. Grounds of Harvard Observatory.
9	1844, Dec.	74 18·2	......	......	Maj. J. D. Graham. Grounds of Harvard Observatory.
10	1845, June 2.	74 19·4	0·1668	0·6174	Dr. J. Locke. Grounds of Harvard Observatory.
11	1850, Aug. 9.	74 34	......	......	Lieut. J. C. Ives and A. W. Whipple. Prob. red'n —10′. Grounds of Harvard Observatory.
12	1854, May 10.	74 33	......	......	
13	1856, July 19.	74 12	0·1633	0·5997	K. Friesach. Grounds of Harvard Observatory.
14	1859, Mar. 7.	74 20	0·1658	0·6140	Lieut. W. P. Smith. Grounds of Harvard Observatory.
15	1879, Aug. 7, 9.	73 48·4	0·1709	0·6128	J. B. Baylor, U. S. Coast & G. S. Grounds of Harvard Observatory.
16	1895, July 17, 19.	73 15·6	0·1731	0·6010	J. B. Baylor, U. S. Coast & G. S. Grounds of Harvard Observatory.

$$\Theta = 71^\circ{\cdot}22 + 3{\cdot}28 \sin (1{\cdot}5\, m + 76^\circ{\cdot}3)$$
$$H = 0{\cdot}166\,1 - 0{\cdot}000\,090\, m + 0{\cdot}000\,005\,8\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1722·8	68·37	68·24	—0·13
1781·0	69·85	69·72	—0·13
1782·4	69·68	69·83	+0·15
1784·0	69·68	69·95	+0·27
1839·7	74·33	74·09	—0·24
1840·5	74·36	74·12	—0·24
1841·4	74·29	74·15	—0·14
1842·4	74·29	74·19	—0·10
1844·9	74·30	74·28	—0·02
1845·4	74·32	74·29	—0·03
1850·6	74·40	74·42	+0·02
1854·4	74 38	74·47	+0·09
1856·5	74·20	74·49	+0·29
1859·2	74·33	74·50	+0·17
1879·6	73·81	74·04	+0·23
1895·5	73·26	73·13	—0·13

Date.	Obs'd H.	Comp'd H.	C—O.
1842·4	0·1682	0·1671	—0·0011
1845·4	668	666	— 02
1856·5	633	659	+ 26
1859·2	658	658	00
1879·6	709	685	— 24
1895·5	0·1731	0·1740	+ 09

Secular variations of the magnetic declination, dip and intensity—**Continued.**

CAMBRIDGE, MASS.—Continued.

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1720	+ 9·0	68·34	......	......
1730	8·4	68·03	......	......
1740	7·85	67·94	......	......
1750	7·41	68·07	......	......
1760	7·09	68·42	......	......
1770	6·91	68·95	......	......
1780	6·88	69·65	......	......
1790	6·99	70·44	......	......
1800	7·24	71·30	......	......
1810	7·63	72·14	......	......
1820	8·12	72·93	......	......
1830	8·70	73·59	......	......
1840	9·32	74·10	0·1676	0·6118
1850	9·97	74·41	661	181
1860	10·60	74·50	658	204
1870	11·18	74·37	666	183
1880	11·68	74·02	686	124
1890	12·08	73·49	718	·6045
1900	+ 12·4	72·79	0·1761	0·5952

BOSTON, MASS.

$\varphi = 42° \ 21'·5$ $\lambda = 71° \ 03'·9$ W. of Gr.

[State House.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700—	10 W.	Edm. Halley's Tabula Nautica.
		10 W.	Prof. J. Winthrop's table.
2	1708—	9 W.	Mathews.
3	1741—	7½ W.	Mathews.
4	1750—	7·8	C. & G. S. Rept. for 1888, p. 308, deduced from observations at 19 stations.
5	1775–76.	7 40 W.	Des Barres' Atlantic Neptune.
6	1782—	7 00 W.	Dr. N. Bowditch.
7	1793—	6 30 W.	Mem. Amer. Acad.
8	1807—	6 05 W.	W. Rotch.
9	1833—	8 00 W.	P. Barlow's isogonic chart.
10	1839—	9 06 W.	W. C. Bond. At Dorchester.
11	1846, Sept. 6, 8.	9 31 W.	Lieut. T. J. Lee. In South Boston.
12	1855, Aug. 24.	10 14 W.	C. A. Schott, U. S. Coast Survey. In South Boston.
13	1872, Sept. 28–30, Oct. 1.	11 15 W.	A. H. Scott, " " " " " " "
14	1877·5.	11 36 W.	I. K. Harris. On Boston Common.
	1884, Oct. 18.	11 31 W.	Lieut. C. C. Cornwell. Not used, reduction to Boston uncertain.
15	1890, Sept. 8, 9.	12 05 W.	J. B. Baylor, U. S. Coast & G. Survey. On Boston Common.

$$D = + 9°·54 + 2·90 \sin (1·32 \, m + 3°·7)^*$$

Date.	Obs'd D.	p.	Comp'd D.	C — O.	Date.	Obs'd D.	p.	Comp'd D.	C — O.
	°		°	°		°		°	°
1700·0	+10·00		+10·26	+0·26	1833·0	+ 8·00		+ 8·61	+0·61
1708·5	9·00		9·70	+0·70	1839·5	9·10		9·03	—0·07
1741·5	7·50		7·66	+0·16	1846·7	9·52		9·51	—0·01
1750·0	7·80		6·97	—0·83	1855·6	10·23		10·10	—0·13
1776·0	7·67	¼	6·65	—1·02	1872·8	11·25		11·15	—0·10
1782·5	7·00		6·65	—0·35	1877·5	11·60		11·40	—0·20
1793·5	6·50		6·65	+0·15	1890·8	+12·08		+11·99	—0·09
1807·5	+ 6·08	¼	+ 7·24	+1·16					

* An observation in 1896 demands $D = + 9°·58 + 2·90 \sin (1·32 \, m + 5°·0)$.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

BOSTON, MASS.—Continued.

DIP AND INTENSITY AT BOSTON.

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1722 ⅔	68	22	......	......	Capt. Othniel Beal. Boston Harbor. Cited by Dr. L. A. Bauer, p. 33 of his inaugural dissertation, Berlin, 1895, from W. Whiston's "The calculations of solar eclipses, etc."
2	1839—	74	19	......	......	W. C. Bond. South Boston Heights.
	1839—	74	16	0·1687	0·6221 / 174 (?)	Prof. E. Loomis.
3	1841, July.	74	09·4	......	......	Maj. J. D. Graham.
4	1842, May 2.	74	05·7	0·1692	0·6178	Dr. J. Locke.
	1842, Oct. 1.	74	12·8	0·1672	0·6145	Sir J. H. Lefroy. South Boston near Grove Hill.
5	1846, Sept. 3–7.	74	12·7	0·1654	0·6079	Capt. T. J. Lee and R. H. Fauntleroy, U. S. Coast S. South Boston Heights.
6	1855, Aug. 24.	74	29·5	0·1634	0·6114	C. A. Schott, U. S. Coast S. South Boston near Blind Asylum.
7	1872, Sept. 27, Oct. 5.	73	30·5	0·1694	0·5969	A. H. Scott and E. Goodfellow, U. S. Coast S. Station as before.
8	1890, Sept. 8, 9.	73	21·3	0·1726	0·6026	J. B. Baylor, U. S. Coast & G. S. Boston Common.

$$\Theta = 71^\circ{\cdot}23 + 3{\cdot}10 \sin\,(1{\cdot}5\, m + 79^\circ{\cdot}2)$$
$$H = 0{\cdot}166\,0 - 0{\cdot}000\,121\, m + 0{\cdot}000\,007\,4\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1722·8	68·37	68·25	—0·12
*1782·5	69·74	70·07	+0·33
1839·5	74·29	74·00	—0·29
1841·5	74·16	74·06	—0·10
1842·5	74·15	74·10	—0·05
1846·7	74·21	74·21	0·00
1855·6	74·49	74·33	—0·16
1872·7	73·51	74·08	+0·57
1890·7	73·36	73·21	—0·15

Date.	Obs'd H.	Comp'd H.	C—O.
1839·5	0·1687	0·1681	—0·0006
1842·5	682	673	— 09
1846·7	654	665	+ 11
1855·6	634	655	+ 21
1872·7	694	671	— 23
1890·7	0·1726	0·1736	+0·0010

* Cambridge value.

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1720	+ 8·9	68·44	......	......
1730	+ 8·3	68·19	......	......
....	......	......	......	......
1830	+ 8·42	73·58	0·1714	0·6063
1840	9·06	74·02	680	102
1850	9·73	74 27	660	123
1860	10·38	74·32	655	124
1870	10·99	74·16	666	104
1880	11·53	73·79	691	057
1890	11·96	73·25	731	·6006
1900	+12·3	72·58	0·1786	0·5966

Secular variations of the magnetic declination, dip and intensity—Continued.

PROVINCETOWN, MASS.

$\varphi = 42° 03'.1$ $\lambda = 70° 11'.3$ W. of Gr.

[Town Hall.]

No.	Date.	D.	References and remarks.
		° ′	
	1609, July 28.	6 W.	H. Hudson. On third voyage, off the Isles of Shoals. Not used.
	1609, July 29.	5½ W.	" " Near Cape Cod. Not used.
1	1620, about.	12·2 W.	R. Dudley's Arcano del Mare.
2	1700—	9½ W.	Edm. Halley's Tabula Nautica.
2	1700—	9·6 W.	C. & G. S. Rept. for 1888, p. 306, deduced from obs'ns at 17 stations.
3	1750—	7·7 W.	" " " " " " " " 308, " " " " 19 "
4	1776—	6½ W.	Chart of Nantucket. Reduction to Provincetown + 45.
5	1833—	8¼ W.	P. Barlow's isogonic chart.
6	1835, Sept.	9 20 W.	Maj. J. D. Graham.
7	1860, Sept. 14, 15.	11 23·5 W.	C. A. Schott, U. S. Coast Survey. Near Town Hall.
8	1890, Sept. 2, 3.	12 37·8 W.	J. B. Baylor, U. S. Coast & G. S. Close to station of 1860.
9	1895, July 11, 12.	12 59·2 W.	" " " " " " " " " Station near Pilgrim House.

$$D = +9°.76 + 3.20 \sin (1.30\, m + 10°.7)$$

Date.	Obs'd D.	p.	Comp. D.	C—O.
	°		°	°
1620·0	+12·20	¼	+12·80	+0·60
1700·0	9·55	½	10·00	—0·45
1750·0	7·70	½	6·97	—0·73
1776·5	6·50		6·57	+0·07
1833·0	8·25	½	9·13	+0·88
1835·7	9·33		9·38	+0·05
1860·7	11·39		11·09	—0·30
1890·7	12·63	2	12·63	0·00
1895·5	+12·99		+12·76	—0·23

DIP AND INTENSITY AT PROVINCETOWN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1860, Sept. 14, 15.	74 09·7	0·1686	0·6177	C. A. Schott, U. S. Coast S. Near Town Hall.
2	1890, Sept. 2, 3.	73 15·0	0·1724	0·5983	J. B. Baylor, U. S. Coast & G. S. Near Town Hall.
3	1895, July 11, 12.	73 03·4	0·1747	0·5995	J. B. Baylor, U. S. Coast & G. S. Near Pilgrim House.

PROVIDENCE, R. I.

$\varphi = 41° 50'.2$ $\lambda = 71° 23'.8$

[Brown University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1717—	9 36 W.	R. Jackson.
2	1769—	6½ W.	Dr. B. West.
3	1815—	6 30 W.	M. Brown, B. Lockwood, and G. Sheldon.
4	1819—	6 37 W.	B. Lockwood (?).
5	1835—	7 34 W.	Silliman's Journal.
6	1840—	8 25 W.	Silliman's Journal.
7	1841—	8 31 W.	Silliman's Journal.
8	1842—	8 39 W.	Silliman's Journal.
9	1843—	8 46 W.	Silliman's Journal.
10	1855, Aug. 20.	9 31·5 W.	C. A. Schott, U. S. Coast S. East of Brown University.
11	1884, June 20.	11 07·7 W.	O. T. Sherman.
12	1885, Apr. 11, 13, 14.	11 09·6 W.	J. B. Baylor, U. S. Coast & G. S. East of Brown University.
13	1895, Aug. 19, 20.	11 35·2 W.	" " " " " " " " " Station of Brown University.

Secular variations of the magnetic declination, dip and intensity—Continued.

PROVIDENCE, R. I.—Continued.

$$D = 9^\circ{\cdot}09 + 3{\cdot}00 \sin(1{\cdot}40\,m - 2^\circ{\cdot}8) + 0{\cdot}15 \sin(6\,m + 117^\circ)$$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.	Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°		°		°	°
1717·5	+9·60		+9·62	+0·02	1842·5	+ 8·65		+ 8·54	—0·11
1769·5	6·50		6·36	—0·14	1843·5	8·77		8·62	—0·15
1815·5	6·50		6·61	+0·11	1855·6	9·52		9·43	—0·09
1819·5	6·62		6·81	+0·19	1884·5	11·13		11·14	+0·01
1835·5	7·57		7·99	+0·42	1885·3	11·16		11·15	—0·01
1840·5	8·42		8·39	—0·03	1895·6	+11·59		11·79	+0·20
1841·5	+8·52		+8·47	—0·05					

DIP AND INTENSITY AT PROVIDENCE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1834, Aug.	74 02·8	......	......	Dr. A. D. Bache. North of Brown University.
2	1835—	....	0·1738	0·6326	" " " " and Prof. E. H. Courtenay. North of Brown University.
3	1839, Sept.	73 59·6	0·1718	0·6230	Prof. E. Loomis. Steamboat landing.
4	1841—	74 02·8	......	......	Dr. A. D. Bache.
5	1842, Sept. 28.	74 00·0	0·1713	0·6215	Sir J. H. Lefroy. Near steamboat landing.
6	1855, Aug. 20.	74 15·9	0·1655	0·6105	C. A. Schott, U. S. Coast S. East of Brown University.
7	1884, June 20.	73 16·6	0·1738	0·6064	O. T. Sherman.
8	1885, Apr. 11, 13, 14.	73 10·5	0·1760	0·6091	J. B. Baylor, U. S. Coast and G. S. East of Brown University.
9	1895, Aug. 19, 20.	72 51·6	0·1776	0·6027	J. B. Baylor, U. S. Coast and G. S. East of Brown University.

$$\Theta = 74^\circ{\cdot}11 - 0{\cdot}001\,4\,m - 0{\cdot}000\,614\,m^2$$
$$H = 0{\cdot}168\,6 - 0{\cdot}000\,198\,m + 0.000\,009\,5\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°		°
1834·6	74·05	73·98	—0·07
1839·7	73·99	74·06	+0·07
1841·5	74·05	74·08	+0·03
1842·7	74·00	74·09	+0·09
1855·6	74·26	74·08	—0·18
1884·5	73·28	73·33	+0·05
1885·3	73·18	73·30	+0·12
1895·6	72·86	72·77	—0·09

Date.	Obs'd H.	Comp'd H.	C—O.
1835·5	0·1738	0·1735	—0·0003
1839·7	718	717	— 01
1842·7	713	706	— 07
1855·6	655	678	+ 23
1884·5	738	732	— 06
1885·3	760	736	— 24
1895·6	0·1776	0·1794	+0·0018

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+ 7·67	73·89	0·1764	0·6357
1840	8·49	74·06	715	244
1850	9·06	74·11	686	158
1860	9·67	74·03	676	092
1870	10·23	73·84	685	054
1880	10 85	73·52	713	038
1890	11·48	73·07	760	043
1900	+12·0	72·51	0·1862	0·6195

Secular variations of the magnetic declination, dip and intensity—Continued.

HARTFORD, CONN.

$\varphi = 41° 45'.9$ $\lambda = 72° 40'.4$ W. of Gr.

[State House.]

No.	Date.	D.	References and remarks.
		° ′	
1	1713—	8 57 W.	From information communicated by Arthur W. Rice in letter dated Hartford, July 25, 1891. According to Mr. Rice, the present (1891·5) declination on the boundary line between townships Hartford and Wethersfield, from records of 1786 and 1825, is 9° 58′ W., deduced from the line west of stone N. F., and 10° 25′ W. from line east of stone N. F.; mean value + 10° 11′·5. From observations recently made near Hartford, 5 values are given, viz: By H. G. Loomis, C. E., + 10° 20′; by Prof. Luther, of Trinity College, + 10°; by Mr. Hale, in Wethersfield, 4 miles south of Hartford, + 10° 06′; by two other engineers of Hartford, + 10° 15′; and by Mr. Rice, in New Britain, about 10 miles from Hartford, + 10°. Mean of 5 values, + 10° 08′, hence I adopt for 1891·5 the value + 10° 10′. The east line bore in 1713, according to record, N. 90° E.; in 1793 it bore N. 86° E.; and in 1891 it bore S. 88° 47′ E.; hence the declination in 1713 was 1° 13′ less than in 1891·5, i. e., 8° 57′ W. Also in 1793 it was 5° 13′ less than in 1891·5, or 4° 57′ W. The west line bore in 1817 S. 85° 15′ W., according to record, and S. 89° 49′ W. in 1891; hence declination in 1817 4° 34′ less than in 1891, or 5° 36′ W.
2	1750—	6·78 W.	According to C. & G. Survey Bulletin No. 6.
3	1786—	5 25 W.	Dr. Williams.
4	1793—	4 57 W.	See above note by A. W. Rice.
5	1810—	4 46 W.	Asher Miller, at East Hartford.
6	1817—	5 36 W.	See above note by A. W. Rice.
7	1824—	5 45 W.	} N. Goodwin.
8	1828–29.	6 03 W.	
9	1859, July 27.	7 17·0 W.	C. A. Schott, U. S. Coast S. In City Park. Reduction to normal value of region + 42′.
10	1867, Aug. 15, 17.	7 49·3 W.	C. A. Schott, U. S. Coast S. Near the Athenæum. Reduction as above.
11	1875 (?).	8 58 W.	T. C. Ellis.
12	1879, July 24, 25, 26.	8 34·0 W.	J. B. Baylor, U. S. Coast & G. S. Station of 1859. Reduction as above.
13	1890, Oct. 13, 14.	9 01·5 W.	J. B. Baylor, U. S. Coast & G. S. Station of 1859. Reduction as above.
14	1891—	10 10 W.	See above note by A. W. Rice.

$D = +8°.06 + 2.98 \sin (1.35\, m - 16°.1)$

Date.	Obs'd D. *p*.	Comp'd D.	C—O.	Date.	Obs'd D. *p*.	Comp'd D.	C—O.
	°	°	°		°	°	°
1713·5	+8·95	+9·10	+0·15	1829·0	+ 6·05	+5·97	—0·08
1750·0	6·78	6·62	—0·16	1859·6	7·99	7·90	—0·09
1786·5	5·42	5·14	—0·28	1867·6	8·52	8·46	—0·06
1793·5	4·95	5·08	+0·13	1875·5	8·97	9·00	+0·03
1810·5	4·77	5·27	+0·50	1879·6	9·27	9·27	0·00
1817·5	5·60	5·48	—0·12	1890·8	9·73	9·93	+0·20
1824·5	+5·75	+5·76	+0·01	1891·5	+10·17	+9·97	—0·20

DIP AND INTENSITY AT HARTFORD.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1839, Sept.	73 58·1	......	......	Prof. E. Loomis. Northwest of statehouse.
2	1859, July 27.	74 07·4	0·1713	0·6262	C. A. Schott, U. S. Coast S. In park.
3	1867, Aug. 15, 17.	73 20·5	0·1753	0·6114	" " " " " Back of Prospect street.
4	1879, July 24, 25.	73 25·7	0·1744	0·6116	J. B. Baylor, U. S. Coast & G. S. In park.
5	1890, Oct. 13, 14.	73 06·0	0·1748	0·6014	" " " " " " "

Secular variations of the magnetic declination, dip and intensity—Continued.

HARTFORD, CONN.—Continued.

DIP AND INTENSITY AT HARTFORD—Continued.

$\Theta = 73°.94 - 0.010\,9\,m - 0.000\,250\,m^2$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1839·7	73·97	74·03	+0·06
1859·6	74·12	73·81	—0·31
1867·6	73·34	73·67	+0·33
1879·5	73·43	73·40	—0·03
1890·8	73·10	73·08	—0·02

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1830	+ 6·02	74·06
1840	6·59	74·03
1850	7·24	73·94
1860	7·93	73·81
1870	8·62	73·62
1880	9·29	73·39
1890	9·89	73·10
1900	+10·4	72·77

NEW HAVEN, CONN.

$\varphi = 41° 18'.5$ $\lambda = 72° 55'.7$ W. of Gr.

[Yale College.]

No.	Date.	D.		References and remarks.
		°	′	
1	1750—	6·24	W.	U. S. Coast & G. S. Bulletin No. 6.
2	1761—	5	47	Pres. Stiles.
3	1775—	5	25	Prof. Strong.
4	1780—	5	15	Pres. Stiles.
5	1811—	5	10	N. Redfield.
	1818, Aug.	5	45	De Witt. Not used.
	1819—	4	35	Prof. Fisher. Not used.
6	1819, May. 1820, Apr.	4	25·4	" "
7	1828—	5	17	N. Goodwin.
8	1834, Nov. 1835, Nov.	5	40·6	Prof. E. Loomis.
	1835—	5	52	Prof. E. Loomis's collection. Not used.
9	1836—	5	55	E. C. Herrick.
10	1837, Nov.	5	50	E. C. Herrick.
11	1840—	6	10	E. C. Herrick.
12	1844, Aug. 28.	5	45·1	Prof. J. Renwick, U. S. Coast S. At Pavilion Hotel.
13	1845, Sept. 10.	6	17·3	Prof. J. Renwick, U. S. Coast S. At Pavilion Hotel.
	1847, Sept. 25, 28, Oct. 1, 2.	7	27·2	R. H. Fauntleroy, U. S. Coast Survey. At Fort Wooster. Not used.
	1848, Aug. 21, 29.	7	25·5	J. S. Ruth, U. S. Coast Survey. At Fort Wooster. Not used.
14	1848, Aug. 10, 12, 14.	6	37·9	J. S. Ruth, U. S. Coast S. Mean = + 6°·58. At Pavilion Hotel.
	1848, Aug. 30, Sept. 1.	6	31·9	At Oyster Point.
15	1855, Aug. 17.	7	02·7	C. A. Schott, U. S. Coast S. At Oyster Point.
	1871, Mar.	7	22	G. H. Mann. Not used. On College Green.
16	1872—	8	27·5	R. M. Bache, U. S. Coast S.
17	1878, July 18.	8	41·2	Dr. T. E. Thorpe. In Prof. Silliman's garden.
18	1884, Jan. to May.	8	50·9	O. T. Sherman. At Yale College observatory grounds.
	1884, June to Dec.	9	01·0	" " " " "
	1884, July 22.	8	46·2	At South End. Not used.
19	1885, Jan. to June.	9	00·3	At Yale College observatory grounds.
20	1895, Aug. 24, 26.	9	36·3 W.	J. B. Baylor, U. S. Coast & G. S. At station north of Yale College.

Secular variations of the magnetic declination, dip and intensity—Continued.

NEW HAVEN, CONN.—Continued.

$$D = +7^{\circ}.72 + 3.03 \sin (1.35\, m - 21^{\circ}.9)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1750·0	+6·24		+6·53	+0·29	1840·5	+6·17		+6·00	—0·17
1761·5	5·78		5·83	+0·05	1844·6	5·75		6·24	+0·49
1775·5	5·42		5·17	—0·25	1845·7	6·29		6·31	+0·02
1780·5	5·25		4·99	—0·26	1848·6	6·58		6·50	—0·08
1811·5	5·17		4·81	—0·36	1855·6	7·05		6·97	—0·08
1819·8	4·42		5·03	+0·61	1872·5	8·46		8·17	—0·29
1828·5	5·28		5·37	+0·09	1878·5	8·69		8·59	—0·10
1835·3	5·68		5·71	+0·03	1884·5	8·93		8·99	+0·06
1836·5	5·92		5·77	—0·15	1885·2	9·00		9·03	+0·03
1837·9	+5·83		+5·85	+0·02	1895·6	+9·60		+9·66	+0·06

DIP AND INTENSITY AT NEW HAVEN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1839, Sept.	73 26·7	0·1767	0·6201	Prof. E. Loomis. Burial Ground.
2	1842, Apr. 21.	73 29·8	0·1761	0·6201	Dr. J. Locke.
	1842, Oct. 18.	73 27·4	0·1766	0·6203	Sir J. H. Lefroy. Near Cemetery.
3	1844, Aug. 27–29.	73 21·0	0·1760	0·6144	Prof. J. Renwick, U. S. Coast S. At Yale College. (Sir E. Sabine.)
		73 27·5	0·1787	0·6276	
4	1847, Sept. 27–Oct. 2.	74 16·6	0·1691	0·6238	R. H. Fauntleroy, U. S. Coast S. At Fort Wooster.
5	1848, Aug. 14–18.	73 31·9	0·1741	0·6142	J. S. Ruth, U. S. Coast S. At Pavilion.
	1848, Aug. 21–26.	74 12·6	0·1668	0·6129	J. S. Ruth, U. S. Coast S. At Fort Wooster.
	1848, Aug. 30, 31.	73 32·9	0·1738	0·6137	J. S. Ruth, U. S. Coast S. At Oyster Point.
6	1855, Aug. 17.	73 44·5	0·1701	0·6076	C. A. Schott, U. S. Coast S. At Oyster Point.
7	1878, July 17, 18.	73 05·4	0·1780	0·6120	Dr. T. E. Thorpe. In Silliman's garden.
8	1884, Jan.–Dec.	72 49·6	0·1785	0·6046	O. T. Sherman. Yale College Observatory.
9	1885, Apr. 22.	72 47·6	0·1798	0·6078	" " " " " "
10	1895, Aug. 24–27	72 28·2	0·1806	0·5996	J. B. Baylor, U. S. Coast & G. S. North of Yale College.

$$\Theta = 73^{\circ}.55 + 0.003\,5\, m - 0.000\,642\, m^2$$
$$H = 0.173\,1 - 0.000\,151\, m + 0.000\,008\,2\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1839·7	73·45	73·45	0·00
1842·5	73·48	73·49	+0·01
1844·6	73·40	73·51	+0·11
1848·6	73·54	73·54	0·00
1855·6	73·74	73·55	—0·19
1878·5	73·09	73·13	+0·04
1884·5	72·83	72·91	+0·08
1885·3	72·79	72·87	+0·08
1895·6	72·47	72·37	—0·10

Date.	Obs'd H.	Comp'd H.	C—O.
1839·7	0·1767	0·1755	—0·0012
1842·5	763	747	— 16
1844·6	773	742	— 31
1847·7	691	735	+ 44
1848·6	716	733	+ 17
1855·6	701	725	+ 24
1878·8	780	756	— 24
1884·5	785	777	— 08
1885·3	798	780	— 18
1895·6	0·1806	0·1832	+0·0026

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+5·44	73·22	0·1794	0·6214
1840	5·97	73·45	754	158
1850	6·59	73·55	731	113
1860	7·28	73·53	724	081
1870	7·99	73·37	734	059
1880	8·69	73·08	760	047
1890	9·33	72·66	802	046
1900	+9·9	72·12	0·1861	0·6061

Secular variations of the magnetic declination, dip and intensity—**Continued.**

NANTUCKET, MASS.

$\varphi=41^\circ\ 17'.0 \qquad \lambda=70^\circ\ 06'.0$ W. of Gr.

[Mitchell's Observatory.]

No.	Date.	D.	References and remarks.
		° ′	
1	{ 1700—	8¼ W.	Edm. Halley's Tabula Nautica.
	{ 1700—	8·6 W.	C. & G. S. Rept. for 1888, p. 306, deduced from observations at 17 stations.
2	1750—	6·9 W.	C. & G. S. Rept. for 1888, p. 308, deduced from observations at 19 stations.
3	1775—	6½ W.	Des Barres' Atlantic Neptune.
	1776—	6½ W.	Chart. Not used.
4	1833—	7½ W.	P. Barlow's isogonic chart.
5	1834—	8 27 W.	} W. Mitchell.
6	1838–39.	9 02·3 W.	
7	1842, Aug. and Sept.	9 09 W.	
8	1843, Sept.	9 10 W.	
9	1846, July 30, 31.	9 14·0 W.	Lieut. T. J. Lee, U. S. E.
10	1855, Aug. 22.	9 58·3 W.	C. A. Schott, U. S. Coast S. Near Harbor light.
11	1867, May 28, 29, 30.	10 19·9 W.	C. O. Boutelle, U. S. Coast S. At the Cliff.
12	1879, July 31, Aug. 2.	11 27·9 W.	J. B. Baylor, " " " & G. S. At the Cliff.
13	1883, June 10.	11 38 W.	Lieut. E. S. Prime, U. S. N. Reduction to station—12′.
14	1895, June 28, 29.	12 11·1 W.	J. B. Baylor, U. S. Coast & G. S. Station of 1879.

$$D=+9^\circ.21+3.03\ \sin\ (1.23\ m+6^\circ.9)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1700·0	+8·42	¼	+9·08	+0·66	1843·7	+ 9·17		+ 9·17	0·00
1750·0	6·90	¼	6·49	—0·41	1846·6	9·23		9·35	+0·12
1775·5	6·50		6·19	—0·31	1855·6	9·97		9·93	—0·04
1833·0	7·50	½	8·48	+0·98	1867·4	10·33		10·65	+0·32
1834·5	8·45		8·57	+0·12	1879·6	11·46		11·29	—0·17
1839·0	9·04		8·86	—0·18	1883·4	11·43		11·46	+0·03
1842·7	+9·15		+9·10	—0·05	1895·5	+12·19		+11·91	—0·28

DIP AND INTENSITY AT NANTUCKET.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1843, Sept.	73 41·2	......	......	W. Mitchell.
2	1846, July 29, Aug. 2.	73 44·4	0·1684	0·6015	Lieut. T. J. Lee, U. S. E. On north beach.
3	1855, Aug. 22.	74 00·6	0·1672	0·6068	C. A. Schott, U. S. Coast S. On beach west of light-house.
4	1867, May 28, June 5.	73 37·6	0·1726	0·6121	C. O. Boutelle, U. S. Coast S. Cliff station.
5	1875, Sept. 15, 17.	73 24·1	0·1760	0·6161	J. M. Poole, " " " "
6	1879, July 31, Aug. 2.	73 15·1	0·1752	0·6078	J. B. Baylor, " " " & G. S. At the cliff.
7	1895, June 28, 29, July 8.	72 40·3	0·1780	0·5976	J. B. Baylor, U. S. Coast & G. S. At the cliff.

$$\Theta=73^\circ.80+0.002\ 8\ m-0.000\ 633\ m^2$$
$$H=0.168\ 0+0.000\ 281\ m-0.000\ 001\ 2\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1843·7	73·69	73·76	+0·07
1846·6	73·74	73·78	+0·04
1855·6	74·01	73·80	—0·21
1867·4	73·63	73·66	+0·03
1875·7	73·40	73·45	+0·05
1879·6	73·25	73·33	+0·08
1895·5	72·67	72·62	—0·05

Date.	Obs'd H.	Comp'd H.	C—O.
1846·6	0·1684	0·1670	—0·0014
1855·6	672	695	+ 23
1867·4	726	725	— 01
1875·7	760	745	— 15
1879·6	752	753	+ 01
1895·5	0·1780	0·1784	+0·0004

Secular variations of the magnetic declination, dip and intensity—Continued.

NANTUCKET, MASS.—Continued.

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1840	+ 8·93	73·71	0·1651	0·5886
1850	9·57	73·80	680	·6022
1860	10·21	73·76	707	104
1870	10·79	73·60	732	135
1880	11·31	73·32	754	111
1890	11·72	72·90	774	·6033
1900	+12·03	72·36	0·1792	0·5914

COLD SPRING HARBOR, LONG ISLAND, N. Y.

$\varphi = 40° \ 52'·5 \qquad \lambda = 73° \ 28'·0$ W. of Gr.

No.	Date.	D.	References.
		° ′	
1	1750—	5·7 W.	C. & G. Survey Bulletin No. 6.
2	1771, June 13.	5 07 W.	H. Lefferd.
3	1818, May.	4 52 W.	E. Hicks.
4	1844, Sept. 15.	6 11·6 W.	Prof. J. Renwick, U. S. Coast S. Mean = 6° 31′ W. At Lloyd's Harbor.
	1844, Sept. 16.	6 50·5 W.	
5	1864, Dec. 28.	7 47 W.	S. V. Whiting.
6	1886, July 7.	8 34 W.	J. and E. Jones.
	1886, Nov. 25.	8 55 W.	E. Jones; from bearings of line Cold Spring Beach to Roswell's Mill. Mean = + 8°·74.
7	1888, Sept. 16, Dec. 13.	8 46 W.	E. Jones. Means of 5, 2, 6, 5, 6 values respectively.
8	1890, June 2–Dec. 22.	8 44 W.	
9	1891, Jan. 13–Dec. 16.	8 49 W.	
10	1892, Mar. 9–Oct. 15.	8 59 W.	
11	1893, Apr. 24–Oct. 15.	9 06 W.	
12	1894, Aug. 22–Dec 26.	9 10 W.	E. Jones. Means of 39, 22, and 4 values respectively. Letter of Feb. 3, 1896.
13	1895, May 2–Dec. 28.	9 12 W.	
14	1896, Jan. 28, 29.	9 14 W.	

$$D = +7°·19 + 2·52 \sin (1·35 \, m - 11°·4)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1750·0	+5·70	½	+5·80	+0·10
1771·4	5·12		4·96	−0·16
1818·4	4·87		5·15	+0·28
1844·7	6·52		6·39	−0·13
1865·0	7·78		7·58	−0·20
1887·7	8·74		8·75	+0·01
1888·8	8·76		8·84	+0·08
1890·7	8·73		8·92	+0·19
1891·4	8·82		8·96	+0·14
1892·3	8·99		8·99	0·00
1893·7	9·10		9·05	−0·05
1894·8	9·17		9·09	−0·08
1895·7	9·20		9·12	−0·08
1896·1	+9·23		+9·14	−0·09

DIP AND INTENSITY AT COLD SPRING HARBOR.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1844, Sept. 15.	72 50·6	0·1778	0·6029	Prof. J. Renwick, U. S. Coast S. At Lloyd's Harbor, Huntington.
	1844, Sept. 16, 17.	72 58·5	0·1795	0·6131	Prof. J. Renwick, U. S. Coast S. At Oyster Bay. (Sir E. Sabine.)
			0·1823	0·6229	
2	1865, Aug. 10–21.	72 56·8	0·1812	0·6178	Dr. A. D. Bache and E. Goodfellow, U. S. Coast S. At West Hills.

Secular variations of the magnetic declination, dip and intensity—Continued.

NEW YORK CITY AND VICINITY.

$\varphi=40^\circ\ 42'.7 \qquad \lambda=74^\circ\ 00'.4$ W. of Gr.

[City Hall.]

No.	Date.	D.	Reference and remarks.
		° ′	
	1580—	10 W.	De Isogonen in the XVI en XVII Eeuw, proefschrift door W.
	1610—	11 W.	Van Bemelen, Utrecht, 1893. Not used.
1	1609, Sept.	8 W.	H. Hudson on his third voyage found 8° W. on the Jersey shore a little below the mouth of the Hudson River. Prob. error ± 2°, estimated.
	1610—	12 W.	De Isogonen, etc., door W. Van Bemelen. Not used.
2	1625, about.	11½ W.	R. Dudley's Arcano del Mare.
	1680—	12 W.	De Isogonen, etc., door W. Van Bemelen; not used. The same remark applies to his charts for 1640 and 1665, which apparently all give too high values.
3	1684—	8¾ W.	P. Welles. [Dr. P. Kalm's "Travels into North America," translated by J. R. Foster, Warrington, 1770.]
4	1686—	9 W.	G. Keith. At Sandy Hook. Variation adopted for line run between E. and W. New Jersey in 1687.
5	1691—	8¾ W.	Duxbury's patent. On Staten Island.
6	1700—	8 20 W.	E. Halley's Tabula Nautica.
		8·1	U. S. Coast and G. S. Bulletin No. 6. Not used.
7	1714—	8¾ W.	J. Beatty. On Livingston Manor.
8	1723—	7 20 W.	G. Burnet.
	1724—	7 20 W.	C. Colden. [Dr. Kalm's Travels, as above.]
9	1750—	6 22 W.	Alexander.
		5 28 W.	U. S. Coast & G. S. Bulletin No. 6. Mean + 5°·92.
10	1755—	5 00 W.	Evans.
	1775—	7 W.	Des Barres' Atlantic Neptune. Not used.
11	1789—	4 20 W.	Prof. E. Loomis' collection.
12	1824—	4 40 W.	Blunt's map.
	1833—	3 W.	P. Barlow's isogonic chart. Not used.
13	1834—	4 50 W.	Capt. Owen.
14	1837—	5 40 W.	Prof. J. Renwick. At Columbia College, near City Hall.
15	1840, June 16 to July 11.	5 01 W.	Lieut. S. C. Rowan, U. S. N. At Howard Station, Staten Island. } Mean + 5°·45.
	1840, July 18 to Oct. 16.	5 53 W.	Lieut. S. C. Rowan, U. S. N. At Bergen Neck.
16	1841—	6 06 W.	Douglas' Map of New Jersey.
	1841—	5 52 W.	W. C. Wetmore, U. S. N. At Court-house, $\phi=40^\circ\ 43'$, $\lambda=74^\circ\ 04'$ Winfield's Land Titles. Prof. G. H. Cook's Magnetic Survey of New Jersey, Trenton, 1888. Mean + 5°·98.
17	1842, Sept.	5 32·5 W.	U. S. Coast S. At Sandy Hook, N. J. Reduction to New York + 20′.
	1844, Jan.	5 51·1 W.	Lieut. G. M. Bache and J. Hall, U. S. N. At Sandy Hook, N. J. Not used.
	1844, Aug. 20, 22.	5 51·0 W.	Prof. J. Renwick. Location as above. Not used.
18	1844, Aug. 24.	6 13·1 W.	" " " At Columbia College, as in 1837.
19	1845, Sept. 4.	6 25·3 W.	" " " " " " " "
20	1846, Apr. 30.	5 09·7 W.	Dr. J. Locke. At Bloomingdale Asylum.
	1846, May 4.	4 57·4 W.	" " " " Mt. Prospect, formerly Flatbush, Brooklyn.
	1846, May 7.	5 37·4 W.	" " " " Station Cole, Staten Island.
	1846, May 14.	5 35·1 W.	" " " " Newark. Mean value + 5°·57.
21	1847, Oct. 16–20.	5 41·0 W.	R. H. Fauntleroy, U. S. Coast S. At station Legget, near Hell Gate.
22	1855, Aug. 7.	6 39·6 W.	C. A. Schott, U. S. Coast S. At Governors Island.
	1855, Aug. 8.	7 02·1 W.	" " " " " " " " Bedloes Id. (now Liberty Id).
	1855, Aug. 11.	6 28·0 W.	" " " " " " " " Receiving Reservoir (now Central Park).
	1855, Aug. 14.	6 11·2 W.	C. A. Schott, U. S. Coast S. At Sandy Hook, N. J. Not used.
23	1860, Sept. 21, 22.	6 44 W.	" " " " " " " " Mount Prospect, Brooklyn.
	1872, Oct. 31, Nov. 1, 2.	8 45·8 W.	A. H. Scott, " " " " " Central Park.
24	1873, Nov. 5, 6, 7, 9.	7 09·0 W.	Dr. T. C. Hilgard. At Sandy Hook, N. J. Reduction to New York + 20′.
25	1874, Aug.	7 23 W.	Chart of Way Reef, Hell Gate.
26	1879, July 17, 18.	7 32·0 W.	J. B. Baylor, U. S. Coast and G. S. At Sandy Hook, N. J. Reduction to New York + 20′.
	1883, Aug. 24.	7 16 W.	Lieut. R. B. Beck. } Naval Professional Papers No. 19. Reduction to Sandy Hook − 9′. Not used.
	1884, May 1.	7 00 W.	" U. Sebree.
	1884, July 17.	7 34 W.	" R. B. Beck.
27	1885, Sept. 30, Oct. 1–4.	7 52·8 W.	J. B. Baylor, U. S. Coast & G. S. At Sandy Hook. Reduction to New York + 20′.
	1885, Oct. 16, 17, 18.	8 59·7 W.	J. B. Baylor, U. S. Coast & G. S. At Riverside Park. Not used.

***Secular variations of the magnetic declination, dip and intensity*—Continued.**

NEW YORK CITY AND VICINITY—Continued.

No.	Date.	D.	References and remarks.	
28	1890, Oct. 19, 20.	8 06·8 W.	J. B. Baylor, U. S. Coast and G. S. At Sandy Hook, near station of 1879.	Reduction to New York +20′.
29	1895, June 21, 22.	8 24·8 W.	J. B. Baylor, U. S. Coast and G. S. At Sandy Hook, near station of 1879.	

$$D = +7^\circ{\cdot}04 + 2{\cdot}77 \sin(1{\cdot}30\, m - 18^\circ{\cdot}1) + 0{\cdot}14 \sin(6{\cdot}3\, m + 64^\circ)$$

Date.	Obs'd. D.	*p*.	Comp'd D.	C—O.	Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°		°		°	°
1609·7	+ 8·00		+8·40	+0·40	1841·5	+6·10		+5·70	−0·40
1625·0	11·50	½	9·56	−1·94	1842·6	5·91		5·75	−0·16
1684·5	8·75		9·26	+0·51	1844·6	6·22		5·87	−0·35
1686·5	9·00		9·19	+0·19	1845·6	6·42		5·93	−0·49
1691·5	8·75		8·97	+0·22	1846·3	5·57		5·96	+0·39
1700·0	8·33		8·55	+0·22	1847·8	5·68		6·05	+0·37
1714·5	8·75		7·73	−1·02	1855·6	6·72		6·52	−0·20
1724·0	7·33		7·13	−0·20	1860·7	6·73		6·84	+0·11
1750·0	5·92		5·58	−0·34	1873·8	7·48		7·65	+0·17
1755·5	5·00		5·30	+0·30	1874·6	7·38		7·71	+0·33
1789·5	4·33		4·29	−0·40	1879·5	7·87		8·00	+0·13
1824·5	4·67		4·88	+0·21	1885·7	8·21		8·35	+0·14
1834·5	4·83		5·33	+0·50	1890·8	8·45		8·54	+0·09
1837·5	5·67		5·48	−0·19	1895·6	+8·75		+8·84	+0·09
1840·6	+ 5·45		+5·65	+0·20					

DIP AND INTENSITY AT NEW YORK AND VICINITY.

No.	Date.	θ.		H.	F.	References.
		°	′			
1	1822, Dec.	73	00·5	0·1836(?)	0·6280(?)	Sir E. Sabine. At Columbia College (old site).
2	1825, Mar.	73	27·0	......	......	Sir J. Franklin. Not used.
3	1831, Apr. 19.	73	00	......	......	Prof. Joslyn.
4	1833, Apr.	72 72	49·3 14(?)	......	......	Capt. Back.
5	1834, Aug.	72	51·7	......	......	Dr. A. D. Bache. At Columbia College (old site).
6	1835—	....		0·1832	0·6215	Dr. A. D. Bache and Prof. E. H. Courtenay. At Columbia College (old site).
7	1839, Sept.	72	52·2	0·1850	0·6280	Prof. E. Loomis. At Columbia College (old site).
8	1841, Apr. 19.	72	41	0·1854	0·6229	Dr. J. Locke. At Columbia College (old site).
	1841, Apr. 20.	72	21	0·1890	0·6233	" " " At new Asylum, near Harlem.
	1841, Apr. 20.	72	39·6	0·1853	0·6217	" " " " Bloomingdale Asylum.
	1841, Dec.	72	39·6	0·1851	0·6211	Dr. A. D. Bache.
9	1842—	72	37·2	0·1858	0·6220	Dr. J. Locke. At Columbia College (old site).
	1842, Sept. 26.	72	35·6	0·1848	0·6190	Sir J. H. Lefroy. At Bloomingdale Asylum.
10	1844, Apr. 26.	72	41·7	0·1847	0·6211	Dr. J. Locke. At Columbia College.
	1844, Apr. 27.	72	42·6	0·1848	0·6215	Dr. J. Locke. " " "
	1844, Aug. 8–31.	72	37·8	0·1877 0·1905(?)	0·6289 0·6400(?)	Prof. J. Renwick. At Columbia College. (Sir E. Sabine).
	1844—	72	28·9	......	......	Maj. J. D. Graham. At Columbia College.
	1844, Sept. 3.	72	49·5	0·1886 0·1848	0·6386 0·6257	Prof. J. Renwick and Sir J. H. Lefroy. At Bloomingdale Asylum.
11	1845, Sept. 4.	72	40·6	......	......	Prof. J. Renwick. At Columbia College.
12	1846, Apr. 27, 30.	72	39·0	0·1848	0·6198	Dr. J. Locke. At Bloomingdale Asylum.
	1846, May 6.	72	27·6	0·1869	0·6202	Dr. J. Locke. At Mount Prospect, Brooklyn.
	1846, Nov.	72	39·3	......	......	Officer of corvette Nordstiernen.
13	1853, May 19.	72	55·6	......	......	Dr. E. K. Kane and A. Sonntag.
14	1855, Aug. 7.	72	46·3	0·1810	0·6109	On Governors Island, C. A. Schott, U. S. Coast S.
	1855, Aug. 8.	72	59·2	0·1807	0·6178	On Bedloes Island, C. A. Schott, U. S. Coast S.
	1855, Aug. 10.	72	44·4	0·1816	0·6119	In Central Park Rec. Reservoir, C. A. Schott, U. S. Coast S.
15	1860, Sept. 20, 21, 22.	72	40·8	0·1868	0·6275	At Mount Prospect, Brooklyn, C. A. Schott, U. S. Coast S.
16	1872, Nov. 1, 4.	72	35·8	0·1836	0·6138	E. Goodfellow and A. H. Scott, U. S. Coast S. Central Park.
17	1885, Oct. 16, 17, 18.	72	12·0	0·1862	0·6090	J. B. Baylor, U. S. Coast & G. S. Riverside Park.

Secular variations of the magnetic declination, dip and intensity—Continued.

NEW YORK CITY AND VICINITY—Continued.

AT SANDY HOOK, N. J

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1844, Aug. 20, 22.	72	37·9	0·1880	0·6299	Prof. J. Renwick.
2	1855, Aug. 14.	72	52·0	0·1806	0·6132	C. A. Schott, U. S. Coast S.
3	1873, Nov. 5–9.	72	29·6	0·1863	0·6192	Dr. T. C. Hilgard.
4	1879, July 17, 18.	72	08·3	0·1880	0·6131	J. B. Baylor, U. S. Coast & G. S.
5	1885, Sept. 30, Oct. 1, 2.	71	52·3	0·1876	0·6023	" " " "
6	1890, Oct. 19, 20.	71	54·1	0·1870	0·6020	" " " "
7	1895, June 21, 22.	71	48·2	0·1894	0·6065	" " " "

For New York. $\Theta = 72^\circ{\cdot}73 - 0{\cdot}009\,8\,m - 0{\cdot}000\,160\,m^2$

" " " $H = 0{\cdot}184\,7 + 0{\cdot}000\,024\,m + 0{\cdot}000\,000\,5\,m^2$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1822·9	73·00	72·88	—0·12
1831·3	73·00	72·86	—0·14
1833·3	72·82	72·85	+0·03
1834·6	72·86	72·84	—0·02
1839·7	72·87	72·80	—0·07
1841·5	72·59	72·80	+0·21
1842·6	72·61	72·79	+0·18
1844·5	72·67	72·78	+0·11
1845·7	72·68	72·77	+0·09
1846·5	72·59	72·76	+0·17
1853·4	72·93	72·70	—0·23
1855·6	72·83	72·67	—0·16
1860·7	72·68	72·61	—0·07
.1872·8	72·60	72·42	—0·18
*1879·5	72·25	72·30	+0·05
1885·8	72·20	72·17	—0·03
*1890·8	72·01	72·06	+0·05
*1895·5	71·91	71·94	+0·04

*Reduced to New York.

Date.	Obs'd H.	Comp'd H.	C—O.
1823·0	0·1836	0·1844	+0·0008
1835·5	832	45	+ 13
1839·7	850	45	— 05
1841·5	862	45	— 17
1842·6	853	46	— 07
1844·5	863	46	— 17
1846·3	858	46	— 12
1855·6	811	48	+ 37
1860·7	868	50	— 18
1872·8	836	55	+ 19
*1879·5	867	58	— 09
1885·8	862	62	00
*1890·8	857	65	+ 08
*1895·5	0·1881	0·1868	—0·0013

*Reduced to New York.

To reduce Sandy Hook to New York series we have the following comparison:

Year.	S. H.	N. Y.
	°	°
1844	72·63	72·67
1855	72·87	72·83
1873	72·50	72·60
1885	71·87	72·20
Mean	72·47	72·58
Diff.		+0·11

To reduce Sandy Hook to New York series we have the following comparison:

Year.	S. H.	N. Y.
1844	0·1880	0·1863
1855	806	811
1873	863	836
1885	876	862
Mean	0·1856	0·1843
Diff.		—0·0013

COMPUTED DECENNIAL VALUES (FOR NEW YORK).

Date.	D.	Θ.	H.	F.
	°	°		
1820	+4·61	72·88	0·1844	0·6264
1830	4·98	72·86	44	·6257
1840	5·61	72·81	45	·6243
1850	6·31	72·73	47	·6222
1860	6·91	72·62	50	·6193
1870	7·40	72·47	54	·6155
1880	7·90	72·29	59	·6111
1890	8·49	72·08	64	·6058
1900	+9·1	71·84	0·1871	0·6003

Secular variations of the magnetic declination, dip and intensity—Continued.

SOUTH BETHLEHEM, PA.

$\varphi = 40° 36'.4$ $\lambda = 75° 22'.9$ W. of Gr.

[Sayre Observatory, Lehigh University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1742·8	6 33 W.	R. W. Walker, from bearings of old lines. Correction in time made by Prof. M. Merriman; letter of Sept. 24, 1891.
2	1784—	2 53 W.	Reference as above.
3	1799—	1 52 W.	Reference as above.
4	1841, July 23.	3 26 W.	Dr. A. D. Bache, at Easton; reduction to Bethlehem — 12′.
5	1851·5	3 50·6 W.	R. W. Walker, from bearings of old lines.
6	1874, June 20.	5 19·5 W.	Dr. T. C. Hilgard, near Lehigh University. $\varphi = 40° 36'.5$, $\lambda = 75° 23'.1$.
7	1878·2	5 37·2 W.	R. W. Walker, from bearings of old lines.
8	1881·2	5 52 W.	Prof. C. L. Doolittle, Lehigh University.
9	1882·7	6 05·4 W.	R. W. Walker. Result from 80 observations made by students.
10	1884·0	6 06·6 W.	" " "
11	1885·3	6·15 W.	Communicated by Prof. M. Merriman, letter of July 14, 1892. In accordance with this letter + 0°·11 was added to each observed value to refer it to Hilgard's station of 1874.
12	1887·3	6·17 W.	"
13	1888·3	6·30 W.	"
14	1889·3	6·37 W.	"
15	1892·3	6·47 W.	"
16	1894·7	7·05 W.	Letter of Prof. M. Merriman of Feb. 11, 1895.

$$D = +5°.27 + 3.05 \sin (1.46m - 34°.8)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1742·8	+6·55	½	+5·86	—0·69	1882·7	+6·09		+5·95	—0·14
1784·5	2·88		2·95	+0·07	1884·0	6·11		6·05	—0·06
1799·5	1·87		2·38	+0·51	1885·3	6·15		6·15	0·00
1841·6	3·43		3·04	—0·39	1887·3	6·17		6·30	+0·13
1851·5	3·84		3·63	—0·21	1888·3	6·30	1½	6·37	+0·07
1874·5	5·32		5·32	0·00	1889·3	6·37	1½	6·44	+0·07
1878·2	5·62		5·61	—0·01	1892·3	6·47	1½	6·65	+0·18
1881·2	+5·87		+5·84	—0·03	1894·7	+7·05		+6·82	—0·23

DIP AND INTENSITY AT SOUTH BETHLEHEM.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1841, July.	72 39·0	0·1900	0·6371	Dr. A. D. Bache. At Easton.
2	1874, June 20.	73 38·9	0·1770	0·6288	Dr. T. C. Hilgard. Near Lehigh College Observatory.

HUNTINGDON, PA.

$\varphi = 40° 31'$ $\lambda = 78° 02'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1750—	4¼ W.	U. S. Coast & G. S. Bulletin No. 6.
2	1794—	0 51 W.	J. S. Lytle.
3	1840, July 30.	1 52·3 W.	Dr. A. D. Bache.
4	1849, May 21.	{1 59 W. {2 23 W.	Report of Secretary of Internal Affairs, Pa.
5	1852, Apr.	2 16 W.	" " " " " "
6	1858, Sept. 10.	2 34 W.	" " " " " "
7	1860, Apr. 19.	2 41 W.	H. Wilson.
8	1874, Aug.	3 34 W.	Report of Secretary of Internal Affairs, Pa.
9	1879, Aug. 19.	4 07 W.	Letter of J. S. Africa.
10	1880, Sept. 24.	4 15·0 W.	Report of Secretary of Internal Affairs, Pa.
11	1881, June 20.	4 23·4 W.	"
12	1883, Apr. 9.	4 33·7 W.	"
13	1884, May 26.	4 37·5 W.	"
14	1885, Dec. 24.	4 38·0 W.	"

Secular variations of the magnetic declination, dip and intensity—Continued.

HUNTINGDON, PA.—Continued.

$$D = +3^{\circ}\cdot76 + 2\cdot93 \sin (1\cdot48\, m - 35^{\circ}\cdot2)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1750·0	+4·25	½	+3·92	—0·33	1874·6	+3·57		+3·82	+0·25
1794·0	0·85		1·18	+0·33	1879·6	4·12		4·20	+0·08
1840·6	1·87		1·55	—0·32	1880·7	4·25		4·28	+0·03
1849·3	2·18		2·03	—0·15	1881·5	4·39		4·34	—0·05
1852·3	2·27		2·22	—0·05	1883·3	4·56		4·47	—0·09
1858·7	2·57		2·65	+0·08	1884·4	4·62		4·55	—0·07
1860·3	+2·68		+2·76	+0·08	1886·0	+4·63		+4·67	+0·04

DIP AND INTENSITY AT HUNTINGDON.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1840, July.	72 17·8	0·1895	0·6238	Dr. A. D. Bache.

NEW BRUNSWICK, N. J.

$\varphi = 40^{\circ}\ 29'\cdot9 \qquad \lambda = 74^{\circ}\ 26'\cdot8$ W. of Gr.

[Rutgers College.]

No.	Date.	D.	References and remarks.
		° ′	
1	1800—	2 24 W.	G. Hill.. } From bearings of old lines.
2	1804—	2 30 W.	M. Cobb. } From bearings of old lines.
3	1811—	3 19 W.	From bearings of old lines.
4	1814·6	3 07 W.	G. Hill. From bearings of old lines.
5	{ 1815·9 { 1830·5	3 13 W. 3 34 (?) W.	G. Hill. From bearings of old lines. Not used.
6	1836·6	4 40 W.	G. Hill. From bearings of old lines.
7	1838·5	4 45 W.	G. Hill. From bearings of old lines.
8	1846·0	5 23 (?) W.	G. Hill. From bearings of old lines.
9	1848·6	5 10 W.	G. Hill. From bearings of old lines.
10	1850·8	5 23 W.	G. Hill. From bearings of old lines.
11	1863·0	6 09 W.	Deed reported by G. Hill.
12	1864—	6 10 W.	G. H. Cook at County Meridian.
13	1866—	6 00 (?) W.	T. N. Doughty.
14	1870—	6 24 W.	From bearings from old lines.
15	1880—	7 15 W.	Prof. E. A. Bowser.
16	1884—	7 30 W.	M. Cobb.
17	1886—	7 30 W.	G. Hill.
18	{ 1887— { 1887·8	7 32 W. 7 34 W.	G. Hill. At Rutgers College and at several stations to the northward.
19	1895, Sept. 3, [illegible]	7 47·0 W.	J. B. Baylor, U. S. Coast & G. S. Grounds of Rutgers College.

$$D = 5^{\circ}\cdot11 + 2\cdot94 \sin (1\cdot30\, m + 4^{\circ}\cdot2)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1800·5	+2·40		+2·56	+0·16	1863·0	+6·15		+6·17	+0·02
1804·5	2·50		2·70	+0·20	1864·5	6·17		6·26	+0·09
1811·5	3·32		3·00	—0·32	1866·5	6·00		6·38	+0·38
1814·6	3·12		3·15	+0·03	1870·5	6·40		6·62	+0·22
1815·9	3·22		3·22	0·00	1880·5	7·25		7·14	—0·11
1836·6	4·67		4·44	—0·23	1884·5	7·50		7·33	—0·17
1838·5	4·75		4·56	—0·19	1886·5	7·50		7·41	—0·09
1846·0	5·38		5·06	—0·68	1887·7	7·55		7·46	—0·09
1848·6	5·17		5·23	+0·06	1895·7	+7·78		+7·74	—0·04
1850·8	+5·38		+5·38	0·00					

Secular variations of the magnetic declination, dip and intensity—Continued.

NEW BRUNSWICK, N. J.—Continued.

DIP AND INTENSITY AT NEW BRUNSWICK.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1844, May 24.	72 43·2	0·1848	0·6224	Dr. J. Locke.
2	1895, Sept. 3, 4, 5.	71 54·4	0·1879	0·6051	J. B. Baylor, U. S. Coast & G. S. At Rutgers College.

JAMESBURG, N. J., AND VICINITY.

$\varphi = 40° \ 21'$ $\lambda = 74° \ 27'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1761—	4 33 W.	H. M. Thomas. From bearings of old lines.
2	1795—	3 11 W.	
3	1799—	2 43 W.	
4	1815—	3 12 W.	
5	1826—	3 50 W.	
6	1829—	3 52 W.	
7	1887—	7 25 W.	

$$D = +6°\cdot03 + 2\cdot94 \sin(1\cdot40\, m - 22°\cdot4)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	
1761·5	+4·55		+4·40	—0·15
1795·5	3·18		3·13	—0·05
1799·5	2·72		3·10	+0·38
1815·5	3·20		3·23	+0·03
1826·5	3·83		3·62	—0·21
1829·5	3·87		3·75	—0·12
1887·5	+7·42		+7·51	+0·09

DIP AND INTENSITY AT JAMESBURG.

(No observations so far as known.)

HARRISBURG, PA.

$\varphi = 40° \ 15'\cdot9$ $\lambda = 76° \ 52'\cdot9$ W. of Gr.

[State Capitol.]

No.	Date.	D.	References and remarks.
		° ′	
1	1795, Aug. 19.	0 26 E.	From map by T. Foster.
2	1840, July 26.	3 12·5 W.	Dr. A. D. Bache. In Capitol Grounds.
3	1843—	2 35 W.	From map by J. Roberts.
4	1854, autumn.	3 06 W.	J. Roberts and S. Hoffer. In grounds of Statehouse.
5	1857, Apr. 29.	3 18·3 W.	J. Ferguson, J. Aspach, and D. Hoffman.
	1857, June 3.	3 20 W.	S. Hoffer.
6	1860–1861.	3 30 W.	H. Page.
7	1862, July 28, 29.	3 44·5 W.	C. A. Schott, U. S. Coast S. In grounds of Statehouse.
8	1874, Oct. and Nov.	4 51 W.	H. Alricks and J. S. Africa.
9	1876, Dec. 2.	5 10 W.	Report of Secretary of State, Pa.
10	1877, Sept. 25, 26.	4 53·5 W.	E. Smith, U. S. Coast S. In grounds of Statehouse.
11	1881, May 25.	5 17 W.	J. B. Kaufman. In Capitol Grounds.
12	1885, Aug. 17, 18, 19.	5 21·9 W.	J. B. Baylor, U. S. Coast & G. S. In Capitol Grounds.
13	1888, Sept. and Oct.	5 31·2 W.	J. S. Wall and J. H. Campbell. " " "
14	1889, Feb. 21.	5 30·9 W.	J. B. Kaufman. In Capitol Grounds.
15	1895, Sept. 19, 20.	6 06·3 W.	J. B. Baylor, U. S. Coast & G. S. On Forster Island.

Secular variations of the magnetic declination, dip and intensity—Continued.

HARRISBURG, PA.—Continued.

$$D = +3^{\circ}.12 + 2.98 \sin (1.55\, m - 4^{\circ}.2)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1795.6	—0.43	¼	+0.14	+0.57	1876.9	+5.17		+4.93	—0.24
1840.5	+3.21	½	2.15	—1.06	1877.7	4.89		4.98	+0.09
1843.5	2.58		2.38	—0.20	1881.4	5.28		5.21	—0.07
1854.8	3.01		3.29	+0.28	1885.6	5.36		5.44	+0.08
1857.4	3.32		3.50	+0.18	1888.8	5.52		5.59	+0.07
1861.0	3.50		3.78	+0.28	1889.1	5.52		5.60	+0.08
1862.6	3.74		3.91	+0.17	1895.7	+6.10		+5.86	—0.24
1874.8	+4.85		+4.79	—0.06					

DIP AND INTENSITY AT HARRISBURG.

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1840, July.	72	20.5	0.1880	0.6198	Dr. A. D. Bache.
2	1862, July 28, 29.	72	31.6	0.1863	0.6205	C. A. Schott, U. S. Coast S. Grounds of Statehouse.
3	1877, Sept. 27.	72	20.5	0.1901	0.6267	E. Smith and J. B. Baylor, U. S. Coast S. Grounds of Statehouse.
4	1885, Aug. 17, 18.	71	45.1	0.1908	0.6091	J. B. Baylor, U. S. Coast & G. S. Grounds of Statehouse.
5	1895, Sept. 19, 20.	71	43.0	0.1908	0.6083	J. B. Baylor, U. S. Coast & G. S. On Forster Island.

$$\Theta = 72^{\circ}.48 + 0.006\,7\, m - 0.000\,563\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1840.5	72.34	72.36	+0.02
1862.6	72.53	72.47	—0.06
1877.7	72.34	72.23	—0.11
1885.6	71.75	71.91	+0.16
1895.7	71.72	71.71	—0.01

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1840	+2.1	72.35
1850	2.90	72.48
1860	3.70	72.49
1870	4.46	72.39
1880	5.12	72.17
1890	5.64	71.85
1900	+6.0	71.41

Secular variations of the magnetic declination, dip and intensity—Continued.

HATBORO, PA.

$\varphi = 40^\circ\ 12'$ $\lambda = 75^\circ\ 07'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1680.	+8 28 W.	Series communicated by E. W. Beans, in letter of March 1, 1852. This series is supposed to rest on reliable observations, but they are now concealed by interpolation. It does not appear to have any connection with values observed at Philadelphia.
2	1690.	8 15 W.	
3	1700.	7 55 W.	
4	1710.	7 28 W.	
5	1720.	7 00 W.	
6	1730.	6 25 W.	
7	1740.	5 35 W.	
8	1750.	4 55 W.	
9	1760.	4 00 W.	
10	1770.	2 55 W.	
11	1780.	2 05 W.	
12	1790.	1 50 W.	
13	1800.	1 55 W.	
14	1810.	2 00 W.	
15	1820.	2 27 W.	
16	1830.	3 00 W.	
17	1840.	3 50 W.	
18	1850.	+4 25 W.	

$$D = +5^\circ\cdot17 + 3\cdot16 \sin(1\cdot54\ m - 16^\circ\cdot7) + 0\cdot22 \sin(4\cdot1\ m + 157^\circ)$$

Date.	Obs'd D. *p*.	Comp'd D.	C—O.	Date.	Obs'd D. *p*.	Comp'd D.	C—O.
	°	°	°		°	°	°
1680·5	+8·47	+8·31	—0·16	1770·5	+2·92	+3·07	+0·15
1690·5	8·25	8·16	—0·09	1780·5	2·08	2·38	+0·30
1700·5	7·92	7·86	—0·06	1790·5	1·83	1·95	+0·12
1710·5	7·47	7·45	—0·02	1800·5	1·92	1·84	—0·08
1720·5	7·00	6·96	—0·04	1810·5	2·00	2·05	+0·05
1730·5	6·42	6·38	—0·04	1820·5	2·45	2·50	+0·05
1740·5	5·58	5·66	+0·08	1830·5	3·00	3·08	+0·08
1750·5	4·92	4·83	—0·09	1840·5	3·83	3·73	—0·10
1760·5	+4·00	+3·93	—0·07	1850·5	+4·42	+4·39	—0·03

DIP AND INTENSITY AT HATBORO.

(No observation so far as known.)

PHILADELPHIA, PA.

$\varphi = 39^\circ\ 56'\cdot9$ $\lambda = 75^\circ\ 09'\cdot0$ W. of Gr.

[Statehouse.]

No.	Date.	D.	References and remarks.
		° ′	
	1620, about.	11¼ W.	R. Dudley's Arcano del Mare. Not used.
1	1701—	8½ W.	Scull.
2	1710—	8½ W.	T. Whitney.
3	1750—	5¾ W.	Dr. P. Kalm's "Travels into North America." English translation by J. R. Foster, 1770.
4	1793—	1½ W.	T. Whitney.
	1793—	1½ W.	Brooks.
5	1802—	1½ W.	Howell.
6	1804—	2 W.	Several observers.
	1804—	2 10 W.	T. Whitney.
7	1813—	2 25 W.	D. McClure.
	1813—	2 27 W.	T. Whitney.
8	1837—	3 25 W.	W. R. Johnson.

Secular variations of the magnetic declination, dip and intensity—Continued.

PHILADELPHIA, PA.—Continued.

No.	Date.	D.	References and remarks.
		° ′	
9	1840, June.	3 37 W.	Dr. A. D. Bache. Grounds of Girard College.
10	1841, July 20 to Nov. 1.	3 53.7 W.	" " " " " " " "
11	1846, May 23.	3 51.1 W.	" J. Locke. " " " "
12	1855, Sept. 5.	4 31.7 W.	C. A. Schott, U. S. Coast S. Grounds of Girard College.
13	1862, Aug. 15, 16.	5 00.0 W.	" " " " " " " " " " " "
14	1872, Oct. 19, 20, 21.	5 27.8 W.	A. H. Scott, " " " " " " " "
15	1877, Oct. 2, 3, 5, 6.	6 02.2 W.	J. B. Baylor, " " " " " " " "
16	1884, Sept. 3, 10, 11.	6 21.6 W.	E. Smith, " " " & G. S. Grounds of Girard College.
17	1890, Nov. 1, 3.	6 31.4 W.	J. B. Baylor, " " " " " " " " " " "
18	1895, Sept. 12, 13.	7 10.5 W.	" " " " " " " " " " In Pennsylvania Hospital Grounds.

$$D = +5^\circ.36 + 3.17 \sin(1.50m - 26^\circ.1) + 0.19 \sin(4.0m + 146^\circ)$$

Date.	Obs'd D.	p. Comp'd D.	C—O.	Date.	Obs'd D.	p. Comp'd D.	C—O.
	°	°	°		°	°	°
1701.5	+8.50	+8.13	—0.37	1841.7	+3.90	+3.57	—0.33
1710.5	8.50	7.81	—0.69	1846.4	3.85	3.85	0.00
1750.5	5.75	5.28	—0.47	1855.7	4.53	4.45	—0.08
1793.5	1.50	2.22	+0.72	1862.6	5.00	4.90	—0.10
1802.5	1.50	2.14	+0.64	1872.8	5.46	5.64	+0.18
1804.5	2.08	2.09	+0.01	1877.7	6.04	6.03	—0.01
1813.5	2.43	2.23	—0.20	1884.7	6.36	6.57	+0.21
1837.5	3.87	3.31	—0.56	1890.8	6.52	7.03	+0.51
1840.5	+3.62	+3.49	—0.13	1895.7	+7.18	+7.40	+0.22

DIP AND INTENSITY AT PHILADELPHIA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1834, July.	72 00.2	......	......	Dr. A. D. Bache and Prof. E. H. Courtenay, Chestnut street.
2	1835—	....	0.1934	0.6261	Dr. A. D. Bache and Prof. E. H. Courtenay, Chestnut street.
3	1836, Sept.	....	0.1918	0.6206	Dr. A. D. Bache, Chestnut street.
4	1838, July.	71 43.9	......	......	" " " " Rittenhouse Square.
5	1839, Sept.	72 07.1	0.1913	0.6231	Prof. E. Loomis, Chestnut street.
6	1840, July, Sept., Oct.	71 53.0	......	......	Dr. A. D. Bache.
	1841, Mar. 30, 31, Apr. 26.	72 00.1	0.1925	0.6230	Dr. A. D. Bache and Dr. J. Locke.
7	1841, Apr. 26, July 20, Oct. 9, Nov. 1.	71 58.7	0.1925	0.6222	Dr. A. D. Bache.
	1841, June.	71 54.5	......	......	Maj. J. D. Graham and Dr. A. D. Bache.
	1842, May 15.	72 01	0.1926	0.6238	Dr. J. Locke. At Girard College.
8	1842, Oct. 6.	71 59.0	0.1925	0.6224	Sir J. H. Lefroy.
	1842—	72 01.8	......	......	Maj. J. D. Graham.
	1842, Jan. to Dec.	72 00.1	0.1925	0.6230	Dr. A. D. Bache.
9	1843, Apr. to Dec.	71 58.2	0.1924	0.6216	" " " "
	1844, Apr. 19.	71 59.2	0.1917	0.6199	Dr. J. Locke.
10	1844, May.	72 09.2	......	......	Maj. J. D. Graham, Rittenhouse Square.
	1844, Jan. to July.	71 57.6	0.1922	0.6206	Dr. A. D. Bache.
11	1845, Jan. to June.	....	0.1921	......	" " " "
12	1846, May 23.	72 01.0	0.1910	0.6186	Dr. J. Locke. At Girard College.
13	1855, Sept. 5.	72 17.7	0.1942	0.6386	C. A. Schott, U.S. Coast S.
14	1862, Aug. 15, 16.	72 05.8	0.1897	0.6173	" " " " " " "
15	1865, Oct. 24.	....	0.1913	......	Prof. W. Harkness, U. S. N. At Navy Yard.
16	1872, Oct. 19–22.	72 15.4	0.1919	0.6296	E. Goodfellow and A. H. Scott, U. S. Coast S. Girard College.

Secular variations of the magnetic declination, dip and intensity—Continued.

PHILADELPHIA, PA.—Continued.

DIP AND INTENSITY AT PHILADELPHIA—Continued.

No.	Date.	Θ.	H.	F.	References.
		° ′			
17	1877, Oct. 2–6.	71 41·3	0·1942	0·6180	J. B. Baylor, U. S. Coast S. Girard College.
18	1884, Aug. 29, 30, 31.	71 30·7	0·1935	0·6101	E. Smith, U. S. Coast & G. S. Exhibition Laboratory.
	1884, Sept. 3–11.	71 27·4	0·1951	0·6136	E. Smith, U. S. Coast & G. S. Girard College.
19	1890, Nov. 1, 3.	71 20·3	0·1934	0·6045	J. B. Baylor, U. S. Coast & G. S. Girard College.
20	1895, Sept. 12, 13.	71 03·4	0·1950	0·6007	J. B. Baylor, U. S. Coast & G. S. Pennsylvania Hospital grounds.

$$\Theta = 72^{\circ}\cdot 13 + 0\cdot 010\ 1\ m - 0\cdot 000\ 743\ m$$
$$H = 0\cdot 191\ 8 - 0\cdot 000\ 022\ m + 0\cdot 000\ 002\ 0\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1834·5	72·00	71·80	—0·20
1838·5	71·73	71·92	+0·19
1839·7	72·12	71·95	—0·17
1840·7	71·88	71·97	+0·09
1841·5	71·96	71·99	+0·03
1842·5	72·01	72·01	0·00
1843·6	71·97	72·04	+0·07
1844·3	72·03	72·05	+0·02
1846·4	72·02	72·08	+0·06
1855·7	72·29	72·16	—0·13
1862·6	72·10	72·14	+0·04
1872·8	72·26	71·97	—0·29
1877·7	71·69	71·84	+0·15
1884·7	71·48	71·59	+0·11
1890·8	71.34	71·31	—0·03
1895·7	71·06	71·04	—0·02

Date.	Obs'd H.	Comp'd H.	C—O.
1835·5	0·1934	0·1925	—0·0009
1836·7	918	24	+ 06
1839·7	913	22	+ 09
1841·5	925	21	— 04
1842·5	925	21	— 04
1843·6	924	20	— 04
1844·3	920	20	00
1845·2	921	20	— 01
1846·4	910	19	+ 09
1855·7	942	17	— 25
1862·6	897	19	+ 22
1865·8	913	20	+ 07
1872·8	919	24	+ 05
1877·7	942	27	— 15
1884·7	943	34	— 09
1890·8	934	42	+ 08
1895·7	0·1950	0·1950	0·0000

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+2·91	71·63	0·1930	0·6124
1840	3·46	71·96	22	6206
1850	4·07	72·13	18	6250
1860	4·73	72·16	18	6261
1870	5·44	72·03	22	6230
1880	6·20	71·76	29	6163
1890	6·97	71·35	41	6070
1900	+7·7	70·78	0·1957	0·5945

Secular variations of the magnetic declination, dip and intensity—Continued.

CHAMBERSBURG, PA.

$\varphi = 39° 56'$ $\lambda = 77° 39'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1736, Nov. 4.	4 15 W.	Z. Butcher.
2	1744, Sept. 11.	3 40 W.	T. Cookson.
3	1746, Mar. 25.	3 19 W.	
4	1754—	3 16 W.	From land patent.
5	1768, May 6, Nov. 1.	1 30 W.	Col. J. Armstrong.
6	1770, Apr. 25.	1 30 W.	
7	1786, Mar. 31.	0 15 W.	M. Henderson.
8	1787, Mar. 7.	0 15 E.	
9	1794—	0 30 E.	
10	1807–'08–'09.	0 42 E.	J. Snively.
11	1816, Nov. 18.	0 30 E.	W. S. Davis.
12	1818, May.	0 22 E.	W. Cummins.
13	1822, Nov. 21.	0 15 E.	W. S. Davis.
14	1825, Dec. 6.	0 00	
15	1830, Nov. 5.	0 15 W.	
16	1836, Mar. 25.	0 27 W.	
17	1840, Aug. 24.	0 54·4 W.	Dr. A. D. Bache. At Irwinsville; reduction to Chambersburg + 5′.
18	1850, Apr. 29.	1 30 W.	J. B. Kaufman.
19	1852, Apr. 12.	1 42 W.	
20	1859, Oct. 24.	2 12 W.	
21	1863, Mar. 25.	2 15 W.	
22	1864, Mar. 31.	2 19 W.	
23	1865, June 1, 19.	2 24 W.	
24	1866, Feb. 23.	2 25 W.	
25	1867, Oct. to Dec.	2 35 W.	
26	1869, May 24.	2 40 W.	
27	1871, Apr., May, and June.	2 55 W.	
28	1873, Apr.	3 00 W.	
29	1876, Apr.	3 15 W.	
	1876, Oct.	3 10 W.	Annual Report Secretary of Internal Affairs, Pa.
30	1877, June.	3 20 W.	J. B. Kaufman.
31	1878, Apr. 22.	3 24 W.	Reduction to mean of day — 3′
32	1879, Apr. 12.	3 31 W.	" " " " " — 3.
33	1880, Apr. 19.	3 36 W.	" " " " " — 4.
34	1881, Apr. 30.	3 41 W.	" " " " " — 5.
35	1882, Apr. 19.	3 45 W.	" " " " " — 4′.
36	1883, Apr. 30.	3 51 W.	
	1883, Oct. 20.	3 47 W.	
37	1884, Apr. 8.	3 49 W.	
38	1885, Apr. 14.	3 54 W.	
	1885, July 8.	3 55 W.	
39	1886, Mar. 4.	3 54 W.	
	1886, Apr. 6.	3 56 W.	
	1886, Apr. 27.	3 57 W.	
	1886, June 4.	3 51 W.	
	1886, Oct. 1.	3 56 W.	
40	1887, Jan. 19.	3 59 W.	
	1887, Jan. 20.	3 58 W.	
	1887, Jan. 21.	3 53 W.	
	1887, Jan. 22.	4 00 W.	
	1887, Mar. 11.	4 00 W.	
	1887, Apr. 26.	4 01 W.	
41	1888, Jan. to Oct.	4 02 W.	
42	1889, Jan. 31, Mar. 6.	4 05 W.	
43	1891, Apr. 6–24.	4 22 W.	J. B. Kaufman at County Meridian. Result reduced to mean of day. Letter of June 27, 1891.
	1891, July 3, 4.	4 27 W.	J. B. Kaufman, near Upper Strasburg. Result reduced to mean of day. Letter of July 6, 1891.
44	1892, Apr. 12.	4 18 W.	J. B. Kaufman, near Chambersburg at County Meridian. Result reduced to mean of day. Letter of May 2, 1892.
45	1893, Apr. 18.	4 32 W.	A. S. Winger. Result reduced to mean of day. Letter of Jan. 18, 1894.

Secular variations of the magnetic declination, dip and intensity—Continued.

CHAMBERSBURG, PA.—Continued.

$D = +2^\circ \cdot 79 + 3 \cdot 10 \sin(1 \cdot 55\, m - 30^\circ \cdot 6) + 0 \cdot 20 \sin(4 \cdot 6\, m + 124^\circ)$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1736·8	+4·25		+4·03	—0·22	1866·1	+2·42		+2·43	+0·01
1744·7	3·67		3·53	—0·14	1867·8	2·58		2·54	—0·04
1746·2	3·32		3·43	+0·11	1869·4	2·67		2·65	—0·02
1754·5	3·27		2·86	—0·41	1871·4	2·92		2·79	—0·13
1768·6	1·50		1·76	+0·26	1873·3	3·00		2·93	—0·07
1770·3	1·50		1·62	+0·12	1876·5	3·21		3·17	—0·04
1786·2	+0·25		0·36	+0·11	1877·4	3·33		3·24	—0·09
1787·2	—0·25		+0·29	+0·54	1878·3	3·35		3·31	—0·04
1794·5	0·50		—0·13	+0·37	1879·3	3·47		3·38	—0·09
1808·5	0·71		0·48	+0·23	1880·3	3·53		3·47	—0·06
1816·9	0·50		0·38	+0·12	1881·3	3·60		3·54	—0·06
1818·4	0·37		0·33	+0·04	1882·3	3·72		3·63	—0·09
1822·9	—0·25		0·17	+0·08	1883·6	3·78		3·72	—0·06
1825·9	0·00		—0·04	—0·04	1884·3	3·82		3·78	—0·04
1830·8	+0·25		+0·22	—0·03	1885·4	3·88		3·87	—0·01
1836·2	0·45		0·52	+0·07	1886·4	3·88		3·95	+0·07
1840·6	0·99		0·79	—0·20	1887·1	4·00		4·01	+0·01
1850·3	1·50		1·39	—0·11	1888·5	4·04		4·13	+0·09
1852·3	1·70		1·52	—0·18	1889·1	4·09		4·17	+0·08
1859·8	2·20		2·01	—0·19	1891·4	4·41		4·31	—0·10
1863·2	2·25		2·23	—0·02	1892·3	4·30		4·37	+0·07
1864·2	2·32		2·30	—0·02	1893·3	+4·53		+4·51	—0·02
1865·4	+2·40		+2·38	—0·02					

DIP AND INTENSITY AT CHAMBERSBURG.

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1842, Apr. 9.	71	57·1	0·1935	0·6248	Dr. J. Locke.

WEST CREEK, LITTLE EGG HARBOR, N. J.

$\varphi = 39^\circ\ 38'$ $\lambda = 74^\circ\ 19'$ W. of Gr.

No.	Date.	D.			References and remarks.
		°	′		
	1609, Oct. 4.	6		W.	H. Hudson, on the coast of New Jersey in $\varphi = 39^\circ\ 30'$, on his third voyage. Prof. E. Loomis in Sill. Jour., vol. XXXIX, 1840. Not used.
1	1687—	9		W.	George Keith, at south end of division line between East and West New Jersey, at Little Egg Harbor. "Report of the Committee of the Council of Proprietors of West New Jersey in relation to the Province Line between East and West New Jersey (1887). Camden, N. J., 1888." Pp. 9, 10. Communicated by Henry S. Haines, Surveyor-General, N. J., letter of July 10, 1891. Prof. G. H. Cook, State Geologist, names Sandy Hook as the place of observation.
2	1700—	6·9		W.	Edm. Halley's Tabula Nautica, Var'm Mag'm Index, juxta obser's anno 1700, per Edm. Halley. Reproduced in Greenwich astronomical observations of 1869.
3	1745—	5	25	W.	Jacob Dennis; see above pamphlet on the division line between East and West New Jersey. J. Lawrence's note on map at West Creek.
4	1860, Aug. 27, 28.	5	18	W.	C. A. Schott, U. S. Coast S., at Long Beach in $\varphi = 39^\circ\ 32'$ $\lambda = 74^\circ\ 15' \cdot 6$ W. of Gr. App. No. 9, C. and G. S. Report for 1881. The reduction to West Creek is zero, or nearly so.
5	1887—	7	10	W.	Henry S. Haines, Surveyor-General, N. J. At West Creek, near the south end of Keith's line of 1687. Reference as above for 1687.
6	1891—	7	25 (?)	W.	An interpolated value, for temporary use, derived from observation of 1887 and the known annual increase of $3' \cdot 6$ on this coast.

Secular variations of the magnetic declination, dip and intensity—Continued.

WEST CREEK, LITTLE EGG HARBOR, N. J.—Continued.

$D = +5^\circ.50 + 2.78 \sin (1.5\, m - 18^\circ.4)$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°
1687·5	+9·00		+8·25	—0·75
1700·0	6·90	¼	7·99	+1·09
1745·5	5·42		5·27	—0·15
1860·7	5·31		5·38	+0·07
1887·5	7·17		7·20	+0·03
1891·5	+7·42 (?)		+7·43	+0·01

DIP AND INTENSITY AT WEST CREEK AND VICINITY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1846, Nov. 7, 9.	72 12·3	0·1873	0·6130	Capt. T. J. Lee, U. S. E. At Tuckerton.
2	1860, Aug. 24–28.	71 58·5	0·1916	0·6193	C. A. Schott, U. S. Coast S. At Long Beach.

BALTIMORE, MD.

$\varphi = 39^\circ\ 17'.8 \qquad \lambda = 76^\circ\ 37'.0$ W. of Gr.

[Washington Monument.]

No.	Date.	D.	References and remarks.
		° ′	
	1620, about.	11(?) W.	R. Dudley's Arcano del Mare. Not used.
1	1640—	9 W.	De Isogonen in de XVI en XVII Eeuw; Proefschrift door W. Van Bemelen. Utrecht, 1893.
2	1679·0	5·25 W.	Derived from magnetic bearings of old lines, 52 cases. Communicated by Thomas Kelbaugh, Aug. 17 and 24, 1877, and Apr. 28, 1879.
3	1683·5	6·25 W.	
4	1703·5	5·12 W.	
5	1720·5	4·21 W.	
6	1729·2	4·02 W.	
7	1754·5	2·28 W.	
8	1756·9	2·88 W.	
9	1771·0	1·11 W.	
10	1776·1	1·75 W.	
11	1780·5	0·77 W.	
12	1787·5	0·37 W.	
13	1808·5	0 12·5 W.	D. Byrnes.
14	1840, Aug. 27.	2 16 W.	Dr. A. D. Bache.
15	1847, Apr. 29.	2 19 W.	Capt. T. J. Lee, U. S. E. At Fort McHenry.
16	1856, Sept. 13.	2 29 W.	C. A. Schott, U. S. Coast S. Near Fort McHenry.
17	1875·5	3·74 W.	T. Kelbaugh, as above.
18	1877, Oct. 10, 11, 12.	4 11 W.	J. B. Baylor, U. S. Coast S. Near Fort McHenry.
19	1885, Aug. 5, 6, 7.	4 29 W.	" " " " " " & G. S. Near Fort McHenry.
20	1895, Sept. 27, 28.	5 20·3 W.	" " " " " " " " Grounds of Fort McHenry.

$D = +3^\circ.38 + 27.2 \sin (1.4\, m - 22^\circ.3)$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1640·5	+9·00	¼	+5·28	—3·72	1780·5	+0·77		+1·02	+0·25
1679·0	5·25	½	6·07	+0·82	1787·5	0·37		0·82	+0·45
1683·5	6·25		6·01	—0·24	1808·5	0·21		0·70	+0·49
1703·5	5·12		5·38	+0·26	1840·7	2·27		1·81	—0·46
1720·5	4·21		4·47	+0·26	1847·3	2·31		2·18	—0·13
1729·2	4·02		3·92	—0·10	1856·7	2·49		2·77	+0·28
1754·5	2·28		2·27	—0·01	1875·5	3·74		4·01	+0·27
1756·9	2·88		2·13	—0·75	1877·8	4·18		4·16	—0·02
1771·0	1·11		1·39	+0·28	1885·6	4·49		4·64	+0·15
1776·1	+1·75		+1·17	—0·58	1895·7	+5·34		+5·19	—0·15

Secular variations of the magnetic declination, dip and intensity—**Continued.**

BALTIMORE, MD.—Continued.

DIP AND INTENSITY AT BALTIMORE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1832, July.	......	0·1949	......	Prof. J. N. Nicollet. Near Washington Monument.
2	1834, July.	70 58·6	......	......	Prof. E. H. Courtenay and Dr. A. D. Bache. At St. Mary's College.
3	1839, Sept.	71 50·3	......	......	Prof. E. Loomis. In Howard's Woods.
4	1840, Aug.	71 34·1	0·1967	0·6221	Dr. A. D. Bache. " " "
5	1841, Apr. 28.	71 34·1	0·1967	0·6221	Dr. J. Locke. At St. Mary's College and near Washington Monument.
	1841, Apr. 28.	71 39·2	0·1956	0·6215	
	1841, Apr. to Sept.	71 43·4	......	......	Maj. J. D. Graham.
	1841, Apr. to Nov.	71 41·5	......	......	Prof. J. D. Nicollet.
6	1842—	71 39·7	......	......	Maj. J. D. Graham. Near Washington Monument.
	1842, Oct. 8.	71 43·3	0·1952	0·6224	Sir J. H. Lefroy. In Howard's Woods and at St. Mary's College.
7	1844, July.	71 36·0	......	......	Maj. J. D. Graham.
8	1856, Sept. 13.	71 45·8	0·1938	0·6192	C. A. Schott, U. S. Coast S. Outside near Fort McHenry.
9	1877, Oct. 11, 12, 13.	71 36·5	0·1958	0·6205	J. B. Baylor, U. S. Coast S. Outside near Fort McHenry.
10	1885, Aug. 5, 6, 7.	71 02·8	0·1945	0·5988	J. B. Baylor, U. S. Coast & G. S. Outside near Fort McHenry.
11	1895, Sept. 27, 28.	71 00·3	0·1956	0·6010	J. B. Baylor, U. S. Coast & G. S. Outside near Fort McHenry.

$$\Theta = 71^{\circ}{\cdot}74 + 0{\cdot}014\,5\,m - 0{\cdot}000\,752\,m^2$$
$$H = 0{\cdot}195\,2 - 9{\cdot}000\,027\,m + 0{\cdot}000\,000\,72\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C — O.
	°	°	°
1834·5	70·98	71·34	+0·36
1839·5	71·84	71·51	—0·33
1840·7	71·57	71·54	—0·03
1841·4	71·62	71·56	—0·06
1842·6	71·69	71·60	—0·09
1844·5	71·60	71·64	+0·04
1856·7	71·76	71·81	+0·05
1877·8	71·61	71·57	—0·04
1885·6	71·05	71·31	+0·26
1895·7	71·00	70·83	—0·17

Date.	Obs'd H.	Comp'd H.	C — O.
1832·5	0·1949	0·1959	+0·0010
1840·6	967	55	— 12
1841·3	962	55	— 07
1842·8	952	54	+ 02
1856·7	938	50	+ 12
1877·8	958	50	— 08
1885·6	945	51	+ 06
1895·7	0·1956	0·1955	—0·0001

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+1·29	71·15	0·1960	0·6066
1840	1·77	71·52	55	·6168
1850	2·35	71·74	52	·6230
1860	2·99	71·81	50	·6247
1870	3·65	71·73	49	·6217
1880	4·30	71·50	50	·6145
1890	4·89	71·12	53	·6035
1900	+5·4	70·59	0·1957	0·5889

Secular variations of the magnetic declination, dip and intensity—Continued.

CAPE MAY, N. J.

$\varphi = 38° 56'.0$ $\lambda = 74° 57'.6$ W. of Gr.

[Light-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700—	6¼ W.	Edm. Halley's Tabula Nautica.
2	1750—	3·8 W.	U. S. C. & G. S. Rept. for 1888, Appendix No. 7, p. 308. Value deduced from observations at 19 stations.
3	1833—	2½ W.	Peter Barlow's isogonic chart. Phil. Trans. Roy. Soc. 1833.
4	1846, June 28.	3 05 W.	Dr. John Locke. Near light-house. App. No. 9, Rept. for 1881.
5	1849·7	3 05 W.	N. C. Price in $\varphi = 38° 56'$, $\lambda = 74° 56'$. Magnetic survey of New Jersey, 1887; Prof. G. H. Cook, geologist in charge.
6	1850·7	3 11 W.	Observer and reference as before.
7	1855, Aug. 3.	3 45·4 W.	C. A. Schott, U. S. Coast S. Near light-house. Appendix No. 9, Rept. for 1881.
8	1857·7	3 30 W.	N. C. Price, reference as before.
9	1874, June 25.	4 38 W.	Dr. T. C. Hilgard. Near the light-house. Appendix No. 9, Rept. for 1881.
10	1881—	5 06 W.	N. C. Price, reference as before.
11	1887·8	5 11 W.	Average of several stations between Cape May City and the light-house. Magnetic survey of New Jersey, 1887; Prof. G. R. Cook, geologist in charge.
12	1891, May 27, 28, 29.	5 40·7 W.	G. R. Putnam, U. S. C. & G. S. Near astronomic station in $\varphi = 38° 55'.8$, $\lambda = 94° 55'.8$.

$$D = +4°.31 + 2.40 \sin(1.4\,m - 26°.7).$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1700·0	+6·25	½	+6·32	+0·07
1750·0	3·80	½	3·76	—0·04
1833	2·50	½	2·46	—0·04
1846	3·08		3·03	—0·05
1849·7	3·08		3·22	+0·14
1850·7	3·18		3·27	+0·09
1855	3·75		3·50	—0·25
1857·7	3·50		3·65	+0·15
1874	4·63		4·60	—0·03
1881·5	5·10		5·03	—0·07
1887·8	5·18		5·37	+0·19
1891·4	+5·68		+5·54	—0·14

DIP AND INTENSITY AT CAPE MAY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1846, June 29.	71 25·8	0·1962	0·6160	Dr. J. Locke.
	1846, June 30.	71 23·6	0·1968	0·6169	Dr. J. Locke. At Townbank.
2	1855, Aug. 3.	71 34·4	0·1928	0·6100	C. A. Schott, U. S. Coast S. Near light-house.
3	1874, June 27.	71 28·5	0·1975	0·6216	Dr. T. C. Hilgard. Near light-house.
4	1891, May 26–29.	70 37·1	0·1996	0·6016	G. R. Putnam, U. S. Coast & G. S. At astronomic station.

$$H = 0.195\,1 - 0.000\,073\,m + 0.000\,004\,66\,m^2$$

Date.	Obs'd H.	Comp'd H.	C—O.
1846·5	0·1965	0·1954	—0·0011
1855·6	928	48	+ 20
1874·4	975	0·1961	— 14
1891·4	0·1996	0·2000	+0·0004

Secular variations of the magnetic declination, dip and intensity—Continued.

WASHINGTON, D. C.

$\varphi = 38° 53'.3 \qquad \lambda = 77° 00'.6.$

[United States Capitol dome.]

No.	Date.	D.	References and remarks.
		° ′	
1	1754·5	2·03 W.	In the place of the value 3°·3 W. formerly used for 1750 and temporarily adopted in order to strengthen the expression for the secular change, I now take the value 2°·03 for 1754·5 depending on the change −0°·37 observed at Baltimore between 1754 and 1855 and applying it to my observation of 1854·5 at Washington. Weight assigned, ½.
2	1780·5	0·30 W.	In a manner similar to the above we have −2°·25 the observed difference at Baltimore between 1780 and 1861, and applying this difference to the mean of the Washington observations of 1860 and 1862, or +2°·55, we get +0°·30. Weight assigned, ¼.
3	1791–92	0·42 E.	Mean of 27 declinations inscribed on boundary stones of the District of Columbia; extracted from "Surveys and Maps of the District of Columbia," by Marcus Baker. Published by the National Geographic Society, Nov., 1894. Weight assigned, 2.
4	1809, Dec.	0 52 W.	N. King. Weight assigned, ¼.
5	1841·0	1 20 W.	Lieut. J. M. Gilliss. North of United States Capitol.
6	1842·0	1 23·9 W.	
7	1855, July.	2 24 W.	C. A. Schott, U. S. Coast Survey. On Capitol Hill near Gilliss station.
8	1856, Aug. 14, 20.	2 21 W.	Near old office building south of Capitol. mean 2° 11′ W.
	1856, Aug.	2 00·9 W.	Park east of Capitol.
9	1857, Mar. 9.	2 24·8 W.	W. Reed. Near Capitol, south side.
10	1860, Aug. 16–Sept. 26.	2 26·7 W.	C. A. Schott, U. S. Coast S. Near old Office building, south of Capitol.
11	1862, Aug. 18, 19.	2 39·4 W.	
12	1863, June 18–July 28.	2 41·8 W.	
13	1866, Nov. 1.	2 44·2 W.	W. Harkness, U. S. N. Grounds of U. S. Naval Observatory (old site). Reduction to C. & G. S. Office station +12′·7 or +0°·21.
14	1867, Jan. to Dec.	2 48·1 W.	C. A. Schott, U. S. Coast S. At observatory in Schott's garden, corner of Second and C streets SE., Capitol Hill. Reduction to C. & G. Survey Office station +11′ or +0°·18.
15	1868, Jan. to Dec.	2 51·2 W.	
16	1869, Jan. to June incl.	2 53·0 W.	
17	1870, June 13, 14, 15.	2 53·6 W.	
18	1871, June 14, 15, 16.	2 56·9 W.	
19	1872, June 14, 15, 17.	3 00·0 W.	
20	1873, June 14, 16, 17.	3 00·1 W.	
21	1874, June 13, 15, 16.	3 07·4 W.	
	1874, July 20, 21, 22.	3 05·2 W.	
22	1875, June 12, 14, 15.	3 15·5 W.	
23	1876, May 1, 2.	3 18·8 W.	
24	1877, June 14, 15, 16.	3 42·1 W.	C. A. Schott, U. S. Coast S. — At observatory in Schott's garden on First and B streets SE., Capitol Hill. Reduction to C. & G. Survey Office station −10′ or −0°·16.
	1877, Aug. 17.	3 36·8 W.	A. Braid, " " "
25	1878, June 14, 15, 17.	3 47·5 W.	C. A. Schott, " " "
	1878, Sept. 8.	3 43·0 W.	Dr. T. E. Thorpe.
26	1879, June 9, 10, 11.	3 50·4 W.	C. A. Schott and Wm. Eimbeck, U. S. Coast & G. S.
27	1880, Feb. 23, 24, 25.	3 52·4 W.	M. Baker, U. S. Coast & G. S.
	1880, Apr. 3.	3 57·2 W.	J. B. Baylor, " " "
	1880, June 12, 14, 17.	3 57·1 W.	" " " "
28	1882, June 15, 16, 17.	3 55·4 W.	W. Eimbeck, " " "
29	1883, June 18, July 5.	4 00·2 W.	C. A. Schott, " " "
30	1884, Feb. 5, 7.	3 57·9 W.	J. E. Maxfield.
	1884, June 16, 17.	4 05·2 W.	C. A. Schott, U. S. Coast & G. S.
31	1885, June 13, 15.	4 11·5 W.	
32	1886, June 14, 15, 16.	4 08·5 W.	
33	1887, July 28, 29.	4 05·0 W.	J. B. Baylor, U. S. Coast & G. S. Near stations of 1856 and 1857, in lot south of new C. & G. S. Office building (1871). $\varphi = 38° 53'.2$ $\lambda = 77° 00'.5$.
34	1888, June 19, 20.	4 08·8 W.	
	1888, Jan. to Dec.	3 58·8 W.	C. C. Marsh, ensign U. S. N. At the U. S. Naval Observatory (old site). $\varphi = 38° 53'.7$, $\lambda = 77° 03'.1$. Reduction to C. & G. Survey Office station +12′·7 or +0°·21. Mean adopted +4°·19.

Secular variations of the magnetic declination, dip and intensity—Continued.

WASHINGTON, D. C.—Continued.

No.	Date.	D.	References and remarks.
		° ′	
35	1889, Jan. to Dec.	4 01·5 W.	J. A. Hoogewerff, ensign U. S. N. At the U. S. Naval Observatory (old site). Reduction to C. & G. S. Office station + 12′·7.
	1889, Sept. 24, 25, 26.	4 15·1 W.	E. D. Preston, U. S. Coast & G. S. Station south of new office, established in 1887.
36	1890, Jan. to Dec.	4 05·8 W.	At U. S. Naval Observatory (old site). Reduction to standard station + 12′·7.
37	1891, Jan. to Dec.	4 09·7 W.	
	1891, Oct. 10, 11, 12.	4 24·3 W.	J. B. Baylor, U. S. Coast & G. S. At standard station in lot south of new C. & G. S. Office building (1871).
38	1892, Jan. to Dec.	4 14·2 W.	At U. S. Naval Observatory (old site). Reduction to standard station + 12′·7.
39	1893, Jan. 3, 4, 5, 6.	4 26·7 W.	R. L. Faris, U. S. Coast & G. S. At standard station.
40	1895, Apr. 16, 17, 18, 19.	4 47·0 W.	

$$D = +2°·53 + 2·64 \sin (1·45\, m - 16°·6)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1754·5	+2·03	½	+1·42	—0·61	1874·5	+3·29		+3·39	+0·10
1780·5	+0·30	¼	+0·19	—0·11	1875·5	3·44		3·45	+0·01
1792·0	—0·42	2	—0·07	+0·35	1876·3	3·49		3·50	+0·01
1809·9	+0·87	¼	—0·02	—0·89	1877·5	3·50		3·58	+0·08
1841·0	1·34		+1·23	—0·11	1878·6	3·59		3·64	+0·05
1842·0	1·40		1·28	—0·12	1879·4	3·68		3·69	+0·01
1855·5	2·40		2·13	—0·27	1880·3	3·76		3·74	—0·02
1856·6	2·19		2·21	+0·02	1882·5	3·77		3·87	+0·10
1857·2	2·41		2·24	—0·17	1883·5	3·84		3·93	+0·09
1860·7	2·44		2·48	+0·04	1884·3	3·87		3·97	+0·10
1862·7	2·66		2·61	—0·05	1885·5	4·03		4·04	+0·01
1863·6	2·70		2·67	—0·03	1886·5	3·99		4·09	+0·10
1866·8	2·95		2·89	—0·06	1887·6	4·08		4·15	+0·07
1867·5	2·98		2·93	—0·05	1888·5	4·19		4·20	+0·01
1868·5	3·03		3·00	—0·03	1889·5	4·23		4·25	+0·02
1869·3	3·06		3·05	—0·01	1890·5	4·31		4·30	—0·01
1870·5	3·07		3·13	+0·06	1891·5	4·37		4·35	—0·02
1871·5	3·13		3·20	+0·07	1892·5	4·45		4·40	—0·05
1872·5	3·18		3·26	+0·08	1893·0	4·45		4·42	—0·03
1873·5	+3·18		+3·32	+0·14	1895·3	+4·78		+4·53	—0·25

DIP AND INTENSITY AT WASHINGTON, D. C.

No.	Date.	θ.	H.	F.	References.	
		° ′				
1	1838—	71 13	......	......	C. Wilkes, U. S. N.	Capitol Park and vicinity.
2	1839, Feb.	71 17·5	......	......	" " " " " and Prof. E. Loomis.	
	1839, Sept.	71 21·4	......	......	Prof. E. Loomis.	
3	1840–41.	71 20·2	......	......	Lieut. J. M. Gilliss.	
4	1841, June and Aug.	71 15·2	......	......	Prof. J. N. Nicollet.	
	1841, July.	71 14·4	......	......	Maj. J. D. Graham and Prof. J. N. Nicollet.	
	1841, Sept.	71 15·9	......	......	Dr. A. D. Bache.	
5	1841–42.	71 18·0	......	......	Lieut. J. M. Gilliss.	
	1842—	71 13·1	......	......	Maj. J. D. Graham.	
	1842, Oct. 10.	71 13·8	0·1990	0·6185	Sir J. H. Lefroy.	
6	1843, Jan.	....	0·1992	......	Dr. A. D. Bache. Near War Department.	
7	1844, Apr. 6.	71 39·3	0·1972	0·6266	Dr. J. Locke. Magnetic Observatory, Capitol Hill.	
	1844, Apr. 8.	71 34·8	0·1971	0·6238	Dr. J. Locke. Georgetown.	
	1844, Apr. 9.	71 13·4	0·1987	0·6174	Dr. J. Locke. Capitol Park.	
	1844, Apr. 10.	71 15·0	0 1978	0·6155	Dr. J. Locke. Near Patent Office.	
	1844, Apr. 11.	71 20·5	0·1986	0·6210	Dr. J. Locke. Near War Department.	
	1844, July.	71 10·6	......	......	Maj. J. D. Graham. Near Capitol.	

Secular variations of the magnetic declination, dip and intensity—Continued.

WASHINGTON, D. C.—Continued.

DIP AND INTENSITY AT WASHINGTON, D. C.—Continued.

No.	Date.	Θ.	H.	F.	References.
		° ′			
8	1845, Jan. to May and Nov.	71 33·9	0·1953	0·6178	Capt. T. J. Lee. Survey Office, south of Capitol.
9	1852, May, June.	71 16·1	0·1967	0·6127	J. E. Hilgard, U. S. Coast S. Northwest of Capitol Hill.
10	1853, May 28.	71 21·4	......	......	Lieut. J. N. Gilliss. Near White House and Navy Department.
11	1855, July and Sept.	71 27·0	0·2000	0·6285	C. A. Schott, U. S. Coast S. — Grounds of Smithsonian Institution.
12	1856, Aug. 15.	71 19·6	0·1986	0·6202	Capitol Hill near C. S. Office.
	1856, Aug. and Sept.	71 21·7	0·1986	0·6215	Capitol Hill near C. S. Office.
13	1857, Mar.	71 22·5	......	......	W. Reed. Capitol Hill near C. S. Office.
14	1858, June 2.	71 22·6	0·1962	0.6144	C. A. Schott, U. S. Coast S. Capitol Hill near C. S. Office.
15	1859, June and July.	71 24·4	0·1986	0·6229	
16	1860, Aug. and Sept.	71 15·9	0·1991	0·6200	
17	1861—	71 18·3	......	......	S. Walker, U. S. Coast S. Capitol Hill near C. S. Office.
18	1862, July, Aug., Sept.	71 18·5	0·1971	0·6152	C. A. Schott, U. S. Coast S. Capitol Hill near C. S. Office.
19	1863, July 18–28.	71 14·3	0·1980	0·6157	
20	1865, June 27.	71 11·7	......	......	
21	1866, Nov. 1.	72 02 —40·0	0·1983 +20	0·6425 —0154	W. Harkness, U. S. N. At U. S. Naval Observatory. Reduction to C. S. Office station —40′·0 for dip, + 20 for H and —154 for F.
22	1867, May 6.	71 58 —40·0	....	....	
	1867, May 6.	71 26	......	......	W. Harkness, U. S. N. C. S. Office station. — Corner 2d and C streets SE.
	1867, Jan. to Dec.	71 06·7	0·1992	0·6154	C. A. Schott and E. Goodfellow, U. S. Coast S.
23	1868, Jan. to Dec.	71 03·4	0·1998	0·6155	C. A Schott, U. S. Coast S.
24	1869, May 15.	71 19·2	......	......	Prof. A. Hall, U. S. N.
	1869, Jan. to July.	70 57·9	0·2004	0·6145	
25	1870, June 13, 14, 15.	70 55·3	0·2007	0·6139	C. A. Schott, U. S. Coast S.
26	1871, June 14, 15, 16.	70 59·9	0·2008	0·6168	
27	1872, June 14, 15, 17.	71 00·6	0·2010	0·6178	
28	1873, June 14, 16, 17.	70 58·5	0·2003	0·6144	
29	1874, June 13, 15, 16.	70 52·4	0·2005	0·6119	
30	1875, June 12, 14, 15.	70 51·0	0·2007	0·6119	
31	1876, May 1, 2.	70 47·3	0·2009	0·6104	C. A. Schott, U. S. Coast S., and F. E. Hilgard.
32	1877, June 14, 15, 16, Aug. and Dec.	70 49·1	0·2015	0·6130	C. A. Schott and A. Braid, U. S. Coast S. — Corner 1st and B streets SE.
33	1878, June, Sept. Dec.	70 48·1	0·2014	0·6124	C. A. Schott, J. B. Baylor, U. S. Coast & G. S., and Dr. T. E. Thorpe.
34	1879, June 9, 10, 11.	70 48·4	0·2015	0·6126	C. A. Schott and Wm. Eimbeck, U. S. Coast & G. S.
35	1880, June 12–17, July 9, 10, 12.	70 44·9	0·2018	0·6115	J. B. Baylor, U. S. Coast & G. S.
36	1881, Apr. 26.	....	0·2020	......	J. B. Baylor, U. S. Coast & G. S.
	1881, June 25, Dec. 17, 23.	70 42·8	......	......	Lieut. S. W. Very, U. S. N.
37	1882, May.	70 47·8	0·2012	0·6101	B. A. Colonna and Wm. Eimbeck, U. S. Coast & G. S.
	1882, June 15, 16, 17.	70 44·1			
	1882, Sept. and Oct.	70 45·2			
38	1883, June 18, July 5.	70 40·8	0·2016	0·6095	C. A. Schott, U. S. Coast & G. S.
39	1884, Jan. and Feb.	70 38·6	0·2017	0·6082	J. E. Maxfield and Wm. Eimbeck, U. S. Coast & G. S.
	1884, June 16, 17.	70 33·2	0·2027	0·6088	C. A. Schott, U. S. Coast & G. S.
40	1885, June 13, 15.	70 32·9	0·2027	0·6089	" " " " " "
41	1886, June 14, 15, 16, 17, 18.	70 30·3	0·2030	0·6085	" " " and E. D. Preston, U. S. Coast & G. S.
42	1887, June 14.	....	0·2031	......	C. A. Schott, U. S. Coast & G. S.
	1887, July 28, 29, 30.	70 26·9	0·2007	0·5996	J. B. Baylor, U. S. Coast & G. S. — At C. and G. Survey Office station, in lot south of building.
43	1888, May 10, 12, 15.	70 25·3	......	......	J. B. Baylor, U. S. Coast & G. S.
	1888, June 19, 20.	....	0·2006	0·5985	J. B. Baylor, U. S. Coast & G. S.
44	1889, Sept. 24, 25, 26.	70 25·8	0·2012	0·6007	E. D. Preston, U. S. Coast & G. S.
	1889, Jan. to Dec.	71 06·0 —40·0	0·1987 +20	0·6134 —·0141	J. E. Hoogewerff, U. S. N. At U. S. Naval Observatory (old site).

Secular variations of the magnetic declination, dip and intensity—Continued.

WASHINGTON, D. C.—Continued.

DIP AND INTENSITY AT WASHINGTON, D. C.—Continued.

No.	Date.	Θ.	H.	F.	References.
		° ′			
45	1890, Jan. to Dec.	71 04·5 −40·0	0·1986 +20	0·6124 −·0141	J. E. Hoogewerff, U. S. N. At U. S. Naval Observatory (old site).
46	1891, Oct. 10, 11, 12.	70 24·2	0·2003	0·5974	J. B. Baylor, U. S. Coast & G. S. At C. & G. Survey Office station.
	1891, Jan. to Dec.	71 05·0 −40·0	0·1986 +20	0·6125 −·0141	J. E. Hoogewerff, U. S. N. At U. S. Naval Observatory (old site).
47	1892, Jan. to Dec.	71 03·9 −40·0	0·1985 +20	0·6117 −·0141	J. E. Hoogewerff, U. S. N. At U. S. Naval Observatory (old site).
48	1893, Jan. 3, 4, 5, 6, 16, 23.	70 12·1	0·2022	0·5967	R. L. Faris, U. S. Coast & G. S. At C. & G. Survey Office station.
49	1895, Apr. 16–19.	70 15·5	0·2011	0·5954	

The observations at Washington for dip and intensity are too numerous to be conveniently used; they were, therefore, first combined into sets of four observations each. The local deflection of the dip at the old Naval Observatory was ascertained by direct comparison, as were also the differences in H and in F, viz:

CORRECTIONS TO OBSERVED VALUES OF THE DIP, THE HORIZONTAL AND TOTAL INTENSITY AT THE OLD NAVAL OBSERVATORY TO REFER THEM TO THE COAST AND GEODETIC SURVEY OFFICE STATION, SOUTH OF THE CAPITOL.

		′	
$\Delta\Theta$ in	1866	−39·2	Mean reduction −40′·0
	1867	−32·0	
	1889	−41·0	
	1890	−41·2	
	1891	−40·8	
	1892	−45·7	

ΔH in	1866	+0·0009	Mean reduction +0·0020
	1889	25	
	1890	21	
	1891	17	
	1892	+0·0027	

and ΔF for the years 1889–1892. Mean = −0·0140.

$$\Theta = 71^\circ{\cdot}36 - 0{\cdot}002\,27\,m - 0{\cdot}000\,540\,m^2$$

$$H = 0{\cdot}197\,9 + 0{\cdot}000\,123\,m - 0{\cdot}000\,000\,717\,m^2$$

Date.*	Obs'd Θ.*	Comp'd Θ.	C−O.
	°	°	°
1840·0	71·29	71·33	+0·04
1846·2	71·36	71·36	0·00
1855·7	71·38	71·33	−0·05
1860·0	71·34	71·28	−0·06
1864·6	71·28	71·21	+0·07
1868·9	71·10	71·12	+0·02
1873·0	70·96	70·02	+0·06
1878·0	70·82	70·87	+0·05
1881·0	70·76	70·77	+0·01
1885·0	70·58	70·62	+0·04
1889·0	70·43	70·45	+0·02
1894·3	70·21	70·20	−0·01

Date.*	Obs'd H.*	Comp'd H.	C−O.
1843·9	0·1978	0·1971	−0·0007
1855·8	979	986	+ 07
1861·6	982	992	+ 10
1868·0	0·1999	0·1999	00
1872·0	0·2007	0·2003	− 04
1876·0	009	006	− 03
1880·0	017	010	− 07
1884·0	019	013	− 06
1888·0	016	016	00
1891·9	009	018	+ 09
1895·8	0·2024	0·2020	−0·0004

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1820	+0·2	.....	0·1936	0·5929
1830	0·65	71·19	52	0·6054
1840	1·17	71·33	66	141
1850	1·77	71·36	79	192
1860	2·43	71·28	0·1991	205
1870	3·10	71·10	0·2001	177
1880	3·72	70·81	010	114
1890	4·28	70·40	017	0·6014
1900	+4·7	69·9	0·2023	0·5886

*Observed values combined in groups of four, inclusive of an observation of 1896; last value of H the mean of two observations.

Secular variations of the magnetic declination, dip and intensity—Continued.

CAPE HENLOPEN, DEL.

$\varphi = 38° 46'.7$ $\lambda = 75° 05'.0$ W. of Gr.

[Light-house.]

No.	Date.	D.	References and remarks.
		° ′	
	1609, Aug. 12.	10 W.	H. Hudson. Off the coast of Maryland in $\varphi = 38° 13'$.
	1609, Oct. 4.	6 W.	H. Hudson. " " " " New Jersey in $\varphi = 39° 30'$. Declination about $7\frac{1}{2}° \pm 3°$; too uncertain for use.
	1620, about.	10½ W.	R. Dudley's Arcano del Mare. Not used.
1	1700—	6 W.	Edm. Halley's Tabula Nautica.
2	1750—	3⅓ W.	C. & G. S. Rept. for 1888, p. 308; value deduced from observations at 19 stations.
3	1795—	0 55 W.	From "Aurora," at Lewiston.
4	1833.0	1 15 W.	P. Barlow's isogonic chart.
	1841, May.	4 42 W.	Barnett. Not used.
5	1843, Oct. and Nov.	2 26.0 W.	S. P. Lee, U. S. N. Near the light-house.
6	1846, July 1.	2 45.0 W.	Dr. J. Locke. At Lewis Landing.
7	1856, Aug. 27.	3 03.9 W.	C. A. Schott, U. S. Coast S. At the light-house.
8	1885, July 29, 30, 31.	4 59.6 W.	J. B. Baylor, U. S. Coast and G. S. At the light-house.

$$D = +4°.01 + 3.22 \sin (1.35\, m - 25°.2)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1700.0	+6.00	¼	+6.39	+0.39
1750.0	3.33	½	2.92	—0.41
1795.5	0.92	½	0.83	—0.09
1833.0	1.25		1.61	+0.36
1843.8	2.43		2.23	—0.20
1846.5	2.75		2.40	—0.35
1856.6	3.07	2	3.11	+0.04
1885.6	+5.00	2	+5.26	+0.26

DIP AND INTENSITY AT CAPE HENLOPEN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1846, July 2.	71 18.5	0.1978	0.6172	Dr. J. Locke. At Pilot Town.
2	1856, Aug. 27.	71 22.0	0.1976	0.6183	C. A. Schott, U. S. Coast S. At light-house.
3	1885, July 29, 30, 31.	70 39.6	0.1985	0.5996	J. B. Baylor, U. S. Coast & G. S. At light-house.

WILLIAMSBURG, VA.

$\varphi = 37° 16'.2$ $\lambda = 76° 42'.4$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1694—	5 W.	Madison.
2	1750—	1 56 W.	C. & G. S. Rept. for 1888, p. 308; value deduced from observations at 19 stations.
3	1780—	0 50 W.	President Madison.
4	1809—	0 30 E.	President Madison.
5	1840—	0 45 W.	Sir E. Sabine's isogonic chart for 1840.
6	1874, Dec. 4–9.	2 12 W.	J. B. Baylor, U. S. Coast S. Grounds of William and Mary College.
7	1887, Apr. 9, 11, 12.	3 02.9 W.	J. B. Baylor, U. S. Coast & G. S. Grounds of William and Mary College.

Secular variations of the magnetic declination, dip and intensity—Continued.

WILLIAMSBURG, VA.—Continued.

$D = +2°.20 + 2.48 \sin (1.5m - 32°.2)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1694.5	+5.00		+4.67	—0.33
1750.0	+1.93		+2.29	+0.36
1780.5	+0.83		+0.49	—0.34
1809.5	—0.55		—0.28	+0.27
1840.0	+0.75		+0.38	—0.37
1874.9	+2.20		+2.43	+0.23
1887.3	+3.05		+3.20	+0.15

DIP AND INTENSITY AT WILLIAMSBURG.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1874, Dec. 4–10.	69 27.6	0.2135	0.6088	J. B. Baylor, U. S. Coast S. College Grounds.
2	1887, Apr. 9–12.	68 56.5	0.2111	0.5874	" " " " & G. S. " "

CAPE HENRY, VA.

$\varphi = 36° \; 55'.6 \qquad \lambda = 76° \; 00'.4$ W. of Gr.

[Light-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700—	4 W.	Edm. Halley's Tabula Nautica.
2	1728, Mar. 6.	3 W.	W. Byrd, at head of Currituck Sound. Reduction to Cape Henry + 20′.
3	1732—	4 42 W.	W. Hoxton, 7 miles from Cape Henry. Reduction to cape — 10′.
	1732—	4 40 W.	Douglass. Not used.
4	1750—	1 47 W.	C. & G. S. Rept. for 1888, p. 308; value deduced from observations at 19 stations.
	1775—	5 00 W.	Des Barres' Atlantic Neptune. Not used.
5	1809—	0 00	President Madison, observation at Norfolk. Reduction to cape doubtful.
6	1832, June 9, 11.	0 45 W.	Prof. J. N. Nicollet.
7	1856, Sept. 11, 12.	1 28 W.	C. A. Schott, U. S. Coast S. Near the light-house.
8	1874, Nov. 26, 27, 28.	2 39.4 W.	Dr. T. C. Hilgard. Near the light-house.
9	1879, May and June.	2 32 W.	Lieut. S. W. Very, U. S. N. Obs'd at the Rip Raps. Reduction to cape + 10′.
10	1881, June 16.	3 11 W.	Lieut. C. P. Perkins, U. S. N. Reduction to cape + 5′.
11	1883, Jan. 2.	3 10 W.	Lieut. G. A. Norris, U. S. N. Reduction to cape + 5.
	1883, June 30.	3 06 W.	Lieut. C. Belknap, U. S. N. Reduction to cape 0.
	1883, Aug. 29.	3 35 W.	Lieut. H. W. Lyon, U. S. N. Reduction to cape — 5.
	1883, Dec. 10.	3 39 W.	Lieut. C. Belknap, U. S. N. Reduction to cape 0.
12	1884, May 10.	3 37 W.	Lieut. F. Hanford, U. S. N. Reduction to cape — 15.
	1884, Oct. 10.	2 55 W.	Lieut. C. C. Cornwell, U. S. N. Reduction to cape + 5.
13	1887, Apr. 14, 15, 16.	3 20.1 W.	J. B. Baylor, U. S. Coast & G. S. Near old light-house.
14	1895, June 13, 14.	3 56.5 W.	

$D = +2°.42 + 2.25 \sin (1.47m - 30°.6)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1700.0	+4.00		+4.55	+0.55	1874.9	+2.66		+2.66	0.00
1728.2	3.33		3.60	+0.27	1879.4	2.70		2.91	+0.21
1732.5	4.53		3.31	—1.22	1881.4	3.27		3.02	—0.25
1750.0	1.78		2.33	+0.55	1883.5	3.37		3.14	—0.23
1809.5	0.00		0.17	+0.17	1884.5	3.18		3.19	+0.01
1832.4	0.75		0.54	—0.21	1887.3	3.34		3.34	0.00
1856.7	+1.47		+1.62	+0.15	1895.5	+3.94		+3.75	—0.19

Secular variations of the magnetic declination, dip and intensity—Continued.

CAPE HENRY, VA.—Continued.

DIP AND INTENSITY AT CAPE HENRY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1856, Sept. 11.	69 39·0	0·2132	0·6128	C. A. Schott, U. S. C. S. } Near light-house.
2	1874, Nov. 26, 27, 28.	69 19·0	0·2134	0·6043	Dr. T. C. Hilgard.
3	1887, Apr. 14, 15.	68 57·6	0·2131	0·5936	J. B. Baylor, U. S. Coast
4	1895, June 13, 14.	68 07·3	0·2201	0·5906	and G. S.

$\Theta = 70^\circ{\cdot}04 - 0{\cdot}035\ 9\ m$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1856·7	69·65	69·80	+0·15
1874·9	69·32	69·15	—0·17
1887·3	68·96	68·70	—0·26
1895·5	68·12	68·41	+0·29

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1850	+1·27	70·04
1860	1·80	69·68
1870	2·37	69·32
1880	2·94	68·96
1890	3·48	68·60
1900	+4·0	68·24

NEWBERN, N. C.

$\varphi = 35^\circ\ 06'$ $\lambda = 77^\circ\ 02'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1750—	0·3 W.	C. & G. S. Rept. for 1888, p. 308; value deduced from observations at 19 stations.
2	1779—	2 09 E.	H. A. Brown, letter of Nov. 6, 1893; from 3 bearings of streets in 1779 and 1810 at which epochs they were the same.
3	1796—	2 40 E.	} J. Price.
4	1806—	2 00 E.	
5	1809—	1 45 E.	
6	1810, Apr. 23.	2 09 E.	H. A. Brown, see above. Diff. of bearings 1810·3 and 1893·8, 4° 23′·3; for 1893·8 I asume 2° 14′ W.
7	1840—	0 00	Sir E. Sabine's isogonic chart for 1840.
8	1874, Dec. 21, 23, 24.	1 20·4 W.	J. B. Baylor U. S. Coast S. At Cemetery.
9	1887, Mar. 19, 20.	1 54·4 W.	" " " " & G. S. At Cemetery.

$D = +0^\circ{\cdot}41 + 2{\cdot}53 \sin (1{\cdot}45\ m - 11^\circ{\cdot}6)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1750·5	+0·30	½	—0·62	+0·92
1779·5	—2·15		—1·90	+0·25
1796·5	—2·67		—2·12	+0·55
1806·5	—2·00		—2·03	—0·03
1809·5	—1·75		—1·97	—0·22
1810·3	—2·15		—1·96	+0·19
1840·5	0·00		—0·68	—0·68
1874·9	+1·34		+1·46	+0·12
1887·2	+1·91		+2·11	+0·20

DIP AND INTENSITY AT NEWBERN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1874, Dec. 21, 24.	67 30·6	0·2286	0·5977	J. B. Baylor, U. S. Coast S. At Cemetery.
2	1887, Mar. 19, 20.	67 02·0	0·2269	0·5815	" " " " & G. S. At Cemetery.

Secular variations of the magnetic declination, dip and intensity—Continued.

MILLEDGEVILLE, GA.

$\varphi = 33° 04'.2$ $\lambda = 83° 12'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1750—	2·05 E.	C. & G. S. Rept. for 1888, p. 308, value deduced from observations at 19 stations.
2	1805—	5 30 E.	J. Bethune.
3	1835—	4 40 E.	" "
4	1838—	5 51 E.	Geological Survey of Georgia.
5	1875, June 15.	4 14·1 E.	J. M. Poole. Bache Fund Observer for National Academy.
6	1887, Mar. 8, 9.	3 36·4 E.	J. B. Baylor, U. S. Coast & G. S.

$D = -3°.10 + 2.53 \sin(1.4\,m - 61°.9)$. A rough expression.

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1750·0	—2·05		—2·16	—0·11
1805·5	5·50		5·18	+0·32
1835·5	4·67	½	5·61	—0·94
1838·5	5·85	½	5·57	+0·28
1875·5	4·24		4·22	+0·02
1887·2	—3·61		—3·53	+0·08

DIP AND INTENSITY AT MILLEDGEVILLE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1887, Mar. 8, 9.	64 34·4	0·2495	0·5812	J. B. Baylor, U. S. Coast & G. S. Capitol Grounds.

CHARLESTON, S. C.

$\varphi = 32° 46'.6$ $\lambda = 79° 55'.8$

[St. Michael's Church.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700—	½ E.	Edm. Halley's Tabula Nautica.
	1700—	½ W.	C. & G. S. Rept. for 1888, p. 307; deduced from observations at 17 stations. Not used.
	1742—	5 23 E.	English Pilot, 1794. Not used.
2	1750—	1 39 E.	C. & G. S. Rept. for 1888, p. 308; deduced from observations at 19 stations.
3	1775—	3 48 E.	Des Barres' Atlantic Neptune.
	1777—	3 48 E.	From a chart. Not used.
4	1784, Feb.	5 15 E.	} J. Purchell.
5	1785, Oct.	5 45 E.	}
6	1824–25.	3 45 E.	Lieut. Sherburne, U. S. N.
7	1833·0	4 00 E.	P. Barlow's isogonic chart.
8	1837—	2 54 E.	Capt. Missroom.
9	1840—	2 44 E.	Dr. C. Davies.
10	1841, May.	2 24 E.	Barnet.
11	1847, Oct.	2 15 E.	Parker.
12	1849, Apr. 1–22.	2 16·5 E.	C. O. Boutelle, U. S. Coast S. At Breach Inlet.
13	1874, May 27, 28, 29.	0 58·2 E.	" " " Fort Marshall.
14	1880, Jan. 21, 22.	0 25·6 E.	J. B. Baylor, U. S. Coast & G. S. " " "
15	1885, Dec. 29, 30.	0 14·2 E.	" " Near Breach Inlet.
16	1895, June 5, 6.	0 19·3 W.	" " " " "

Secular variations of the magnetic declination, dip and intensity—Continued.

CHARLESTON, S. C.—Continued.

$$D = -1^{\circ}.82 + 2.75 \sin (1.40\, m - 12^{\circ}.1)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1700·0	—0·50	½	+0·06	+0·56	1840·5	—2·73		—2·99	—0·26
1750·0	1·65		—3·10	—1·45	1841·4	2·40		2·93	—0·53
1775·5	3·80		4·28	—0·48	1847·8	2·25		2·53	—0·28
1784·1	5·25		4·48	+0·77	1849·3	2·28		2·43	—0·15
1785·8	5·75		4·51	+1·24	1874·4	0·97		0·76	+0·21
1825·0	3·75		3·83	—0·08	1880·1	0·43		0·42	+0·01
1833·0	4·00		3·42	+0·58	1886·0	—0·24		—0·08	+0·16
1837·5	—2·90		—3·17	—0·27	1895·4	+0·32		+0·33	+0·01

DIP AND INTENSITY AT CHARLESTON.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1833, Jan.	....	0·2730(?)	......	Prof. J. N. Nicollet.
2	1849, Apr. 6–25.	64 31·9	0·2558	0·5947	C. O. Boutelle, J. Hewston, and G. W. Dean, U. S. Coast S. At Breach Inlet.
3	1874, May 27, 28.	....	0·2550	......	C. O. Boutelle, U. S. Coast S. At Fort Marshall.
4	1880, Jan. 21, 22.	64 13·7	0·2550	0·5864	J. B. Baylor, U. S. Coast & G. S. At Breach Inlet.
5	1885, Dec. 29, 30.	64 02·7	0·2518	0·5753	J. B. Baylor, U. S. Coast & G. S. At Breach Inlet.
6	1895, June 5, 6.	63 59·0	0·2519	0·5742	J. B. Baylor, U. S. Coast & G. S. At Breach Inlet.

$$\Theta = 64^{\circ}.53 - 0.012\ 1\ m$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1849·3	64·53	64·54	+0·01
1880·1	64·23	64·17	—0·06
1886·0	64·05	64·09	+0·04
1895·4	63·98	63·99	+0·01

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1840	—3·03	64·75
1850	2·39	64·53
1860	1·73	64·41
1870	1·07	64·29
1880	—0·45	64·17
1890	+0·09	64·05
1900	+0·5	63·93

SAVANNAH, GA.

$\varphi = 32^{\circ}\ 04'.9$ $\lambda = 81^{\circ}\ 05'.5$

No.	Date.	D.	References and remarks.
		° ′	
1	1750—	2·2 E.	C. & G. S. Rept. for 1888, p. 308, value deduced from observations at 19 stations.
2	1817—	4 E.	Becquerel's Cartes du Depot.
3	1833·0	5 E.	P. Barlow's isogonic chart.
4	1838—	5 05 E.	Geological Survey.
5	1839—	3 31 E.	Dr. Posey.
6	1852, Apr. 26, 27, 28.	3 40·3 E.	J. E. Hilgard, U. S. Coast S. On Hutchinsons Island.
7	1857, May 1, 2.	3 27·5 E.	C. A. Schott, " " " " " "
8	1874, Mar. 8, 9, 10.	2 16·9 E.	F. Blake and C. Tappan, U. S. Coast S. On Hutchinsons Island.
9	1886, Jan. 6, 7.	1 37·2 E.	J. B. Baylor, U. S. Coast & G. S. " " "
10	1895, May 29, 30.	0 57·2 E.	" " " " " " "

Secular variations of the magnetic declination, dip and intensity—Continued.

SAVANNAH, GA.—Continued.

$D = -1^{\circ}.94 + 2.75 \sin (1.35\, m - 42^{\circ}.0)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1750.0	—2.20		—2.08	+0.12
1817.5	4.00		4.68	—0.68
1833.0	5.00		4.43	+0.57
1838.5	5.08		4.26	+0.82
1839.5	3.52		4.22	—0.70
1852.3	3.67		3.67	0.00
1857.3	3.46		3.40	+0.06
1874.2	2.28		2.39	—0.11
1886.0	1.62		1.62	0.00
1895.4	—0.95		—1.03	—0.08

DIP AND INTENSITY AT SAVANNAH.

No.	Date.	Θ.	H.	F.	References.	
		° ′				
1	1852, Apr. 24–27.	63 40.0	0.2594	0.5847	J. E. Hilgard, U. S. Coast S.	Hutchinsons Island.
2	1857, May 1, 2.	63 44.3	0.2612	0.5902	C. A. Schott, "	
3	1874, Mar. 5–10.	63 53.9	0.2563	0.5823	C. Tappan and F. Blake, U. S. Coast S.	
4	1886, Jan. 6, 7.	63 18.3	0.2562	0.5704	J. B. Baylor, U. S. Coast and G. S.	
5	1895, May 29, 30.	63 16.7	0.2552	0.5676	J. B. Baylor, U. S. Coast and G. S.	

$\Theta = 63^{\circ}.63 + 0.021\, 1\, m - 0.000\, 682\, m^2$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1852.3	63.67	63.69	+0.02
1857.3	63.74	63.76	+0.02
1874.2	63.90	63.75	—0.15
1886.0	63.30	63.52	+0.22
1895.4	63.28	63.19	—0.09

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1850	—3.78	63.64
1860	3.25	63.78
1870	2.65	63.79
1880	2.01	63.66
1890	1.37	63.39
1900	—0.8	62.98

FERNANDINA, FLA.

$\varphi = 30^{\circ}\ 40'.3 \qquad \lambda = 81^{\circ}\ 27'.7$ W. of Gr.

[Astronomic station of 1856–57.]

No.	Date.	D.	References and remarks.
		° ′	
1	1849—	4 30 E.	U. S. Deputy Surveyor at Fernandina in $\varphi = 30^{\circ} 40'.6$, $\lambda = 81^{\circ} 27'.6$. Letter of W. P. Paret, U. S. assistant engineer, dated Jan. 24, 1891.
2	1857, Apr. 20.	4 02 E.	C. A. Schott, U. S. Coast S. At geodetic station "Fernandina" in $\varphi = 30^{\circ} 40'.6$, $\lambda = 81^{\circ} 27'.6$. Appendix No. 9, Rept. for 1881.
3	1875, May 14.	2 55 E.	J. M. Poole, Bache Fund observer to National Academy. Appendix No. 14, Rept. for 1882. At station of 1857.
4	1879, Feb. 3, 4, 12.	2 30 E.	S. M. Ackley, Lieut. U. S. N. and Asst. C. & G. S. On Indian mound near geodetic station, $\varphi = 30^{\circ} 40'.3$, $\lambda = 81^{\circ} 27'.3$. Appendix No. 9, Rept. for 1881.
5	1889—	1 57 E.	W. P. Paret, U. S. assistant engineer. At Amelia light-house in $\varphi = 30^{\circ} 40'.4$, $\lambda = 81^{\circ} 26'.4$. Letter of Jan. 24, 1891.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

FERNANDINA, FLA.—Continued.

$D = -3^\circ{\cdot}18 - 0{\cdot}065\ (1870{\cdot}2 - t)$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1849·5	—4·50		—4·52	—0·02
1857·3	4·03		4·01	+0·02
1875·4	2·92		2·84	+0·08
1879·1	2·50		2·60	—0·10
1889·5	—1·95		—1·96	—0·01

DIP AND INTENSITY AT FERNANDINA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1857, Apr. 6, 10, 20.	62 07·3	0·2715	0·5807	C. A. Schott, U. S. Coast S.
2	1879, Feb. 3–12.	61 53·6	0·2701	0·5733	Lieut. S. M. Ackley, U. S. N.

GROUP II.

Secular variations of the magnetic declination, dip and intensity.

[Central stations.]

YORK FACTORY, HUDSON BAY.

$\varphi = 56^\circ\ 59'{\cdot}9 \qquad \lambda = 92^\circ\ 26'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1725—	19 W.	Capt. Middleton.
2	1787—	5 W.	Hansteen's isogonic chart.
3	1819, Sept.	6 00 E.	Sir J. Franklin.
4	1843, July 24, 26.	9 01 E.	Sir J. H. Lefroy.
5	1857, Aug.	7 37 E.	R. B. Blakiston.
	1878—	5 30 E.	A. R. C. Selwyn. Not used.
6	1879—	7 00 E.	A. R. C. Selwyn.
7	1884, Sept. 12, 13.	6 40 E.	O. J. Klotz.

$D = +7^\circ{\cdot}34 + 16{\cdot}03 \sin (1{\cdot}10\, m - 97^\circ{\cdot}9)$. Approximate expression.

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1725·5	+19·00	¼	+20·43	+1·43
1787·0	+ 5·00		+ 3·79	—1·21
1819·7	— 6·00		— 4·69	+1·31
1843·6	9·01		8·12	+0·89
1857·6	7·62		8·66	—1·04
1879·5	7·00		7·22	—0·22
1884·7	— 6·66		— 6·48	+0·18

Secular variations of the magnetic declination, dip and intensity—Continued.

YORK FACTORY, HUDSON BAY—Continued.

DIP AND INTENSITY AT YORK FACTORY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1843, July 24–26.	83 47·2	0·0701	0·6479	Sir J. H. Lefroy, Diary Magnetic Survey of Canada, London, 1883.
2	1845, Nov. 5, 1846, May 16.	83 42·6	......	......	J. Rae.
3	1847, Sept. 18.	83 47·0	......	......	J. Rae.
4	1857, Aug.	83 53	......	......	R. B. Blakiston.
5	1884, Sept. 11.	83 46·9	0·0696	0·6421	O. J. Klotz.

FORT ALBANY.

$\varphi=52° 22'$ $\lambda=82° 38'$ W. of Gr.

No.	Date.	D.	References and remarks.
		°	
1	1668—	19¼ W.	C. Hansteen's Magnetismus der Erde.
2	1730, Aug. 22.	23 W.	Capt. Middleton.
3	1774, Sept. 14.	17 W.	Hutchins.
4	1840–45.	7½ W.	Sir E. Sabine's isogonic chart.
5	{ 1880—	11 W.	Equal magnetic variation chart, Brit. Admiralty.
	{ 1880—	10 W.	" " " " Deutsche Seewarte.

$D=+15°{\cdot}78+6{\cdot}95 \sin(1{\cdot}20\, m-99°{\cdot}6)$. An approximate expression.

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1668·5	+19·25		+20·48	+1·23
1730·6	23·00		21·97	—1·03
1774·7	17·00		16·99	—0·01
1842·5	7·50		9·19	+1·69
1880·0	+10·50	2	+ 9·56	—0·94

DIP AND INTENSITY AT FORT ALBANY.

No.	Date.	Θ.	H.	F.	Reference.
		° ′			
1	1775—	79 20	......	......	Hutchins. Hansteen's Erdmagnetismus.

DULUTH, MINN., AND SUPERIOR CITY, WIS.

$\varphi=46° 45'{\cdot}5$ $\lambda=92° 04'{\cdot}5$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
	1824·5	12½ E.	Capt. Bayfield, R. N.; near Fond du Lac. Not used.
1	1859, July.	9 25 E.	Lieut. W. P. Smith. At Minnesota Point.
2	1861—	10 12 E.	Survey of N. and NW. Lakes.
3	1870, Sept. 20.	10 30 E.	Gen. C. B. Comstock. At Superior City, Wis., Fourth street and Becker avenue.
4	1871, June 20, 27.	10 40 E.	Gen. C. B. Comstock. At North Base, Minnesota Point.
	1873, Aug. 13, 15.	11 52 E.	Capt. A. N. Lee. At Duluth. Not used.
5	1880, Aug. 21, 23.	9 45 E.	J. B. Baylor, U. S. Coast & G. S. At Superior City, Wis.
	1891, Aug. 25.	12 46·9 E.	" " " " " " Duluth. Not used; supposed locally affected.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

DULUTH, MINN., AND SUPERIOR CITY, WIS.—Continued.

$D = -7°.70 + 2.41 \sin(1.4m - 120°.0)$. Very uncertain.

Date.	Obs'd D. *p.*	Comp'd D.	C—O.
	°	°	°
1859·5	— 9·42	—10·01	—0·59
1861·5	10·20	10·04	+0·16
1870·7	10·50	10·11	+0·39
1871·5	10·67	10·11	+0·56
1880·6	— 9·76	—10·05	—0·29

DIP AND INTENSITY AT DULUTH AND SUPERIOR CITY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1859, July 22.	76 44	0·1486	0·6473	Lieut. W. P. Smith, U. S. Lake S. At Minnesota Point.
2	1871, June 16–25.	76 23·5	0·1518	0·6453	Gen. C. B. Comstock, U. S. Lake S. At Minnesota Point Base.
3	1873, Aug. 12, 13, 14.	76 17	0·1565	0·6602	Capt. A. N. Lee, U. S. Lake S. At Duluth.
4	1880, Aug. 21, 23.	76 26·1	0·1504	0·6410	J. B. Baylor, U. S. Coast & G. S. At Superior City.
5	1891, Aug. 25.	76 25·8	0·1468	0·6257	J. B. Baylor, U. S. Coast & G. S. Not used; supposed locally affected. [Sch.]

SAULT STE. MARIE, MICH.

$\varphi = 46° 29'.9$ $\lambda = 84° 20'.1$ W. of Gr.

[Garden at Fort Brady.]

No.	Date.	D.	References and remarks.
		° ′	
1	1790—	0	Alex. Mackenzie.
	1819, May 2.	2 33 E.	Sir J. Franklin. Not used.
2	1843—	1 08 E.	Sir J. H. Lefroy.
3	1844, Nov. 4.	1 01 E.	Sir J. H. Lefroy.
4	1845—	0 46 E.	Sir J. H. Lefroy.
5	1846, Nov.	0 40 E.	Lieut. G. C. Westcott.
6	1856, Sept. 29.	0 32 E.	K. Friesach.
7	1873, July 22, 23.	0 05 W.	Capt. A. N. Lee, U. S. Lake S.
8	1879, Nov. 12.	1 01 W.	City Surveyor. At Fort Brady.
9	1880, July 11, 13, 14, 17, 19.	0 53·7 W.	Lieut. S. W. Very, U. S. N. In vegetable garden at Fort Brady.
9	1880, Aug. 6, 7.	1 04·5 W.	J. B. Baylor, U. S. Coast & G. S. In military post garden.
10	1891, July 29.	1 50·6 W.	" " " " " " " " "

$D = +1°.54 + 2.70 \sin(1.45\,m - 58°.5)$

Date.	Obs'd D. *p.*	Comp'd D.	C—O.
	°	°	°
1790·5	0·00	+0·01	+0·01
1843·5	—1·13	—0·96	+0·17
1844·8	1·02	0·93	+0·09
1845·5	0·77	0·91	—0·14
1846·8	0·67	0·87	—0·20
1856·7	—0·54	—0·49	+0·05
1873·6	+0·08	+0·43	+0·35
1879·8	1·02	0·82	—0·20
1880·6	0·99	0·88	—0·11
1891·6	+1·84	+1·63	—0·21

Secular variations of the magnetic declination, dip and intensity—Continued.

SAULT STE. MARIE, MICH.—Continued.

DIP AND INTENSITY AT SAULT STE. MARIE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1841, Aug.	77 29·7	......	......	Prof. E. Loomis. SE. of Fort Brady.
2	1843, June.	77 30·2	0·1404	0·6492	Dr. J. Locke.
3	1856, Sept. 29.	77 44	0·1407	0·6624	K. Friesach.
4	1873, July 22, 23.	77 30	0·1404	0·6485	Capt. A. N. Lee, U. S. Lake S.
5	1880, July 11, 13, 19.	....	0·1383	......	Lieut. S. W. Very, U. S. N.
	1880, Aug. 6, 7.	77 24·0	0·1409	0·6460	J. B. Baylor, U. S. Coast & G. S.
6	1891, July 29.	77 00·2	0·1416	0·6297	" " " " "

$$\Theta = 77^\circ{\cdot}63 + 0{\cdot}011\ 78\ m - 0{\cdot}000\ 653\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1841·6	77·50	77·49	—0·01
1843·5	77·50	77·53	+0·03
1856·7	77·73	77·68	—0·05
1873·6	77·50	77·54	+0·04
1880·6	77·40	77·38	—0·02
1891·6	77·00	76·99	—0·01

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1840	—1·04	77·45
1850	—0·76	·63
1860	—0·34	·68
1870	+0·21	·61
1880	+0·84	·39
1890	+1·52	77·06
1900	+2·2	76·59

PIERREPONT MANOR, N. Y.

$\varphi = 43^\circ\ 44'{\cdot}5 \qquad \lambda = 76^\circ\ 03'{\cdot}0$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1823, Sept. 18.	2 16 W.	W. C. Pierrepont.
2	1847, Sept. 18.	4 23 W.	V. Colvin.
3	1856, Nov. 25.	5 10 W.	
4	1860, July 15–16.	5 36 W.	
5	1863, July 10.	5 44 W.	
6	1864, Apr. 12.	5 50 W.	
7	1865, May 4, June 4.	6 00 W.	
8	1866, Sept. 11.	6 15 W.	
9	1867, July 27.	6 10 W.	
10	1868, May 12.	6 10 W.	
11	1869, May 11.	6 18 W.	
12	1870, May 27, Sept. 21.	6 04 W.	
13	1874—	6 44 W.	
	1874, Oct. 20.	6 12 W.	Dr. T. C. Hilgard. On Pierrepont's meridian line, stone in pasture.

$$D = +5^\circ{\cdot}95 + 3{\cdot}78 \sin\left(1{\cdot}4\ m - 22^\circ{\cdot}2\right)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1823·7	+2·27		+2·71	+0·44	1866·7	+6·25		+6·03	—0·22
1847·7	4·38		4·33	—0·05	1867·6	6·17		6·11	—0·06
1856·9	5·17		5·13	—0·04	1868·4	6·17		6·19	+0·02
1860·5	5·60		5·45	—0·15	1869·4	6·30		6·28	—0·02
1863·5	5·73		5·73	0·00	1870·5	6·06		6·38	+0·32
1864·3	5·83		5·81	—0·02	1874·8	+6·55		+6·77	+0·22
1865·4	+6·00		+5·91	—0·09					

Secular variations of the magnetic declination, dip and intensity—Continued.

PIERREPONT MANOR, N. Y.—Continued.

DIP AND INTENSITY AT PIERREPONT MANOR.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1874, Oct. 20.	75 25·1	0·1600	0·6354	Dr. T. C. Hilgard.
2	1884, June 6, 7, 9.	....	0·1599	......	J. B. Boutelle, U. S. Coast & G. S. At Mannsville.

TORONTO, CANADA.

$\varphi = 43° 39'.4$ $\lambda = 79° 23'.3$ W. of Gr.

[Magnetic Observatory.]

No.	Date.	D.	References and remarks.
		° ′	
1	1840, Jan.	1 27 W.	Capt. C. J. B. Riddell.
2	1841·5	1 14·3 W.	
3	1842·5	1 19·1 W.	
4	1845·5	1 29·1 W.	
5	1846·5	1 30·8 W.	
6	1847·5	1 33·2 W.	
7	1848·5	1 35·4 W.	
8	1849·5	1 36·9 W.	
9	1850·5	1 38·6 W.	
10	1851·5	1 40·9 W.	
11	1853, July and Aug.	1 46·1 W.	
12	1854, Feb., Mar., Apr., June.	1 48·0 W.	
13	1855, Aug. to Dec., incl.	1 52·3 W.	
14	1856·5	1 56·3 W.	Toronto Magnetical and Meteorological Observatory. Abstracts of results from 1841 to 1871. Toronto, 1875. G. T. Kingston, Director.
15	1857·5	2 00·5 W.	
16	1858·5	2 04·5 W.	
17	1859·5	2 07·4 W.	
18	1860·5	2 10·6 W.	
19	1861·5	2 14·3 W.	
20	1862·5	2 15·7 W.	
21	1863·5	2 19·1 W.	
22	1864·5	2 21·9 W.	
23	1865·5	2 24·8 W.	
24	1866·5	2 27·6 W.	
25	1867·5	2 29·8 W.	
26	1868·5	2 33·2 W.	
27	1869·5	2 37·1 W.	
28	1870·5	2 41·9 W.	
29	1871·5	2 47·9 W.	
30	1872·5	2 53·0 W.	
31	1873·5	2 58·3 W	
32	1874·5	3 04·1 W.	
33	1875·5	3 11·7 W.	C. Carpmael, Director of Observatory.
34	1876·5	3 18·5 W.	
35	1877·5	3 24·9 W.	
36	1878·5	3 31·4 W.	
37	1879·5	3 37·3 W.	
38	1880, Oct. 18.	3 41·1 W.	C. Carpmael.
39	1884, Aug.	3 57·2 W.	O. J. Klotz.
40	1895, Mar.	4 46·8 W.	Communication by O. J. Klotz, dated Ottawa, Apr. 4, 1895.

***Secular variations of the magnetic declination, dip and intensity*—Continued.**

TORONTO, CANADA—Continued.

$$D = +3^\circ{\cdot}60 + 2{\cdot}82 \sin(1{\cdot}4\, m - 44^\circ{\cdot}7) + 0{\cdot}09 \sin(9{\cdot}3\, m + 136^\circ) + 0{\cdot}08 \sin(19\, m + 247^\circ)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C — O.	Date.	Obs'd D.	*p.*	Comp'd D.	C — O.
	°		°	°		°		°	°
1840·1	+1·45		+1·36	—0·09	1863·5	+2·32		+2·33	+0·01
1841·5	1·24		1·40	+0·16	1864·5	2·36		2·37	+0·01
1842·5	1·32		1·45	+0·13	1865·5	2·41		2·41	0·00
1845·5	1·48		1·52	+0·04	1866·5	2·46		2·45	—0·01
1846·5	1·51		1·54	+0·03	1867·5	2·50		2·50	0·00
1847·5	1·55		1·56	+0·01	1868·5	2·55		2·55	0·00
1848·5	1·59		1·57	—0·02	1869·5	2·62		2·62	0·00
1849·5	1·62		1·59	—0·03	1870·5	2·70		2·69	—0·01
1850·5	1·64		1·62	—0·02	1871·5	2·80		2·78	—0·02
1851·5	1·68		1·66	—0·02	1872·5	2·88		2·88	0·00
1853·5	1·77		1·76	—0·01	1873·5	2·97		2·98	+0·01
1854·5	1·80		1·82	+0·02	1874·5	3·07		3·09	+0·02
1855·5	1·87		1·88	+0·01	1875·5	3·19		3·20	+0·01
1856·5	1·94		1·95	+0·01	1876·5	3·31		3·30	—0·01
1857·5	2·01		2·02	+0·01	1877·5	3·41		3·41	0·00
1858·5	2·07		2·08	+0·01	1878·5	3·52		3·50	—0·02
1859·5	2·12		2·14	+0·02	1879·5	3·62		3·58	—0·04
1860·5	2·18		2·20	+0·02	1880·8	3·68		3·67	—0·01
1861·5	2·24		2·25	+0·01	1884·6	3·95		3·87	—0·08
1862·5	+2·26		+2·29	+0·03	1895·2	+4·78		+4·51	— 0·27

DIP AND INTENSITY AT TORONTO MAGNETICAL AND METEOROLOGICAL OBSERVATORY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1841, 12 months.	75 16·6	......	......	Capts. C. J. B. Riddell and C. Younghusband.
2	1842, Oct. 26.	14·7	0·1630	0·6407	Sir J. H. Lefroy.
	1842, 12 months.	16·4	......	......	Capt. C. Younghusband.
3	1843, Aug.	11·4	0·1631	0·6385	Dr. A. D. Bache.
	1843, 12 months.	14·7	......	......	Capt. C. Younghusband.
4	1844, June 19.	12·5	0·1633	0·6400	Dr. J. Locke.
	1844, June 20.	13·4	0·1632	0·6409	
	1844, 12 months.	14·8	......	......	Capt. C. Younghusband and Sir J. H. Lefroy.
5	1845, "	15·5	0·1636	0·6428	Sir J. H. Lefroy.
6	1846, "	15·1	0·1633	0·6415	
7	1847, "	15·3	0·1631	0·6409	
8	1848, "	18·3	0·1629	0·6423	
9	1849, "	18·8	0·1631	0·6433	
10	1850, "	20·0	0·1629	0·6432	
11	1851, "	20·4	0·1628	0·6431	
12	1852, "	20·5	0·1621	0·6405	
13	1853, "	22·2	......	......	Sir J. H. Lefroy and G. T. Kingston.
14	1854, "	23·0	......	......	G. T. Kingston.
15	1855, 12 months for Θ, Sept. to Dec. for *H* and *F*.	23·5	0·1621	0·6427	
16	1856, 12 months.	24·1	0·1616	0·6411	
17	1857, "	24·3	0·1608	0·6383	
18	1858, "	24·4	0·1609	0·6387	
19	1859, June 25, 30.	24	0·1605	0·6363	Lieut. W. P. Smith, U. S. Lake S.
	1859, 12 months.	25·0	0·1606	0·6374	G. T. Kingston.
20	1860, "	24·6	0·1604	0·6368	
21	1861, "	23·8	0·1606	0·6371	
22	1862, "	23·2	0·1607	0·6369	
23	1863, "	21·5	0·1609	0·6364	
24	1864, "	20·9	0·1611	0·6368	
25	1865, "	21·0	0·1610	0·6368	
26	1866, "	19·2	0·1611	0·6355	
27	1867, "	18·8	0·1613	0·6361	
28	1868, "	20·1	0·1613	0·6371	
29	1869, "	16·7	0·1613	0·6349	
30	1870, "	16·3	0·1613	0·6345	
31	1871, "	75 16·8	0·1614	0·6352	
32	1885, Apr.	74 52	0·1656	0·6343	C. Carpmael.
33	1895, Mar.	74 33·7	0·1664	0·6252	O. J. Klotz.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

TORONTO, CANADA—Continued.

DIP AND INTENSITY AT TORONTO MAGNETICAL AND METEOROLOGICAL OBSERVATORY—Continued.

Combining the dip observations up to 1869, inclusive, to form groups of 4, the means can be represented by the expression

$$\Theta = 75^\circ{\cdot}341 + 0{\cdot}008\ 784\ m - 0{\cdot}000\ 589\ m^2$$

and combining the values of the horizontal component of force similarly, the latter can be expressed by

$$H = 0{\cdot}162\ 30 - 0{\cdot}000\ 154\ m + 0{\cdot}000\ 005\ 8\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1843·0	75·26	75·25	—0·01
1847·0	·27	·31	+ ·04
1851·0	·33	·35	+ ·02
1855·0	·39	·37	— ·02
1859·0	·41	·37	— ·04
1863·0	·37	·35	— ·02
1867·0	·33	·32	— ·01
1870·5	·27	·28	+ ·01
1871·5	75·28	75·26	— ·02
1885·3	74·87	74·92	+ ·05
1895·2	74·56	74·53	— ·03

Date.	Obs'd H.	Comp'd H.	C—O.
1844·1	0·1632	0·1634	+0·0002
1848·0	·1631	·1626	— 05
1852·6	·1625	·1619	— 06
1858·0	·1610	·1615	+ 05
1862·0	·1606	·1613	+ 07
1866·0	·1611	·1613	+ 02
1870·0	·1613	·1615	+ 02
1871·5	·1614	·1617	+ 03
1885·3	·1656	·1641	— 15
1895·2	0·1664	0·1672	+0·0008

COMPUTED DECENNIAL VALUES.

Year.	D.	Θ.	H.	F.
	°	°		
1840	+1·32	75·19	0·1644	0·6434
1850	1·60	·34	1623	414
1860	2·17	·37	1613	388
1870	2·66	·28	1615	357
1880	3·62	75·07	1629	325
1890	4·12	74·75	1654	289
1900	+4·8	74·31	0·1691	0·6251

GRAND HAVEN, MICH.

$\varphi = 43^\circ\ 05'{\cdot}2$ $\lambda = 86^\circ\ 12'{\cdot}6$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1825—	3¾ to 6 E.	L. Lyon.
2	1837—	4½ and 6¼ E.	Geologic Report.
3	1859, Aug. 18.	4 24 E.	Lieut. W. P. Smith.
4	1865—	4 15 E.	Col. Raynolds, Survey N. and NW. Lakes.
	1865, Sept.	4 20 E.	J. de la Camp.
5	1871, July 31.	3 33 E.	L. Foote.
6	1873, Aug. 28, 29.	3 28 E.	Capt. A. N. Lee, U. S. Lake S.
7	1880, July 20, 21.	2 25·7 E.	J. B. Baylor, U. S. Coast & G. S. Grounds of the county court-house.
8	1891, July 22.	1 39·1 E.	

Secular variations of the magnetic declination, dip and intensity—Continued.

GRAND HAVEN, MICH.—Continued.

$D = -4^{\circ}.95 + 0.038\,0\,m + 0.001\,15\,m^2$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1825·5	—5·25		—5·16	+0·09
1837·5	5·08		5·24	—0·16
1859·6	4·40		4·47	—0·07
1865·6	4·25		4·07	+0·18
1871·6	3·55		3·57	—0·02
1873·7	3·47		3·38	+0·09
1880·5	2·43		2·72	—0·29
1891·5	—1·65		—1·39	+0·26

DIP AND INTENSITY AT GRAND HAVEN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1859, Aug. 18.	74 10	0·1759	0·6449	Lieut. W. P. Smith, U. S. Lake S.
2	1873, Aug. 27, 28, 29.	73 58	0·1775	0·6427	Capt. A. N. Lee, "
3	1880, July 20, 21.	73 53·7	0·1774	0·6395	J. B. Baylor, U. S. Coast & G. S. Grounds of county court-house.
4	1891, July 22.	73 34·7	0·1773	0·6271	

$\Theta = 74^{\circ}.37 - 0.017\,8\,m$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1859·6	74·17	74·20	+0·03
1873·7	73·97	73·95	—0·02
1880·5	73·90	73·83	—0·07
1891·6	73·58	73·63	+0·05

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1850	—4·95	74·37
1860	4·45	74·19
1870	3·71	74·01
1880	2·73	73·84
1890	—1·6	73·66
1900	......	73·48

MILWAUKEE, WIS.

$\varphi = 43^{\circ}\ 02'.5$ $\lambda = 87^{\circ}\ 54'.2$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1859, Aug. 20.	6 20 E.	Lieut. W. P. Smith, U. S. Lake S.
2	1871, May.	6 43 E.	Maj. D. C. Houston.
3	1873, Aug. 22.	6 22 E.	Capt. A. N. Lee, U. S. Lake S.
4	1882, Sept.	4 55 E.	Maj. D. C. Houston. At breakwater.
5	1888, Aug. 25, 27.	4 22·3 E.	J. B. Baylor, U. S. Coast & G. S. West of North Point light-house.

$D = -4^{\circ}.12 + 3.60 \sin (1.45\,m - 64^{\circ}.5)$. A weak expression.

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1859·6	—6·34		—6·90	—0·56
1871·4	6·72		6·11	+0·61
1873·6	6·37		5·94	+0·43
1882·7	4·92		5·18	—0·26
1888·7	—4·37		—4·65	—0·28

Secular variations of the magnetic declination, dip and intensity—Continued.

MILWAUKEE, WIS.—Continued.

DIP AND INTENSITY AT MILWAUKEE.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1859, Aug. 20.	73 57	0·1779	0·6435	Lieut. W. P. Smith, U. S. Lake S.
2	1873, Aug. 22.	73 43	0·1797	0·6409	Capt. A. N. Lee, “
3	1888, Aug. 25, 27.	73 48·0	0·1765	0·6327	J. B. Baylor, U. S. Coast & G. S. Near North Point light-house.

BUFFALO, N. Y.

$\varphi = 42° 52'.8$ $\lambda = 78° 53'.5$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
	1789, June 29.	4 06 W.	From a surveyor's MS., not used. 7 miles south of Buffalo.
1	1797—	0	A. Atwater. East end of Lake Erie.
2	1798—	0½ W.	A. Porter. Buffalo Reservation, lake shore.
3	1837—	1 25 W.	R. W. Haskins.
4	1839—	1 15 W.	U. S. Lake Survey, at Fort Erie.
5	1845—	1 25 W.	Sir J. H. Lefroy.
6	1859, June.	2 56 W.	Lieut. W. P. Smith, U. S. Lake S. Near South Pier.
7	1872, June 14.	3 52 W.	Capt. A. N. Lee, U. S. Lake S. At Fort Porter.
8	1873, June 4, 5.	3 58 W.	
9	1885, Sept. 17, 18, 19.	5 04·3 W.	J. B. Baylor, U. S. Coast & G. S. At Fort Porter.
10	1893, Mar.	5 20 W.	E. S. Nott, surveyor; letter of Mar., 1893.

$$D = +3°.66 + 3.47 \sin (1.4\, m - 27°.8)$$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1797·5	0·00		+0·26	+0·26
1798·5	+0·50		0·24	—0·26
1837·5	1·42		1·19	—0·23
1839·5	1·25		1·31	+0·06
1845·5	1·42		1·71	+0·29
1859·5	2·94		2·79	—0·15
1872·5	3·87		3·89	+0·02
1873·5	3·97		3·97	0·00
1885·7	5·07		4·98	—0·09
1893·2	+5·33		+5·54	+0·21

DIP AND INTENSITY AT BUFFALO.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1839, Aug.	74 40·8	......	......	Prof. E. Loomis.
2	1844, June 23.	74 36·5	0·1689	0·6364	Dr. J. Locke.
3	1845, Oct. 20.	74 37·8	0·1674	0·6314	Sir J. H. Lefroy.
4	1859, June 11.	74 47	0·1663	0·6337	Lieut. W. P. Smith, U. S. Lake S.
5	1872, June 13, 14.	74 43	0·1680	0·6374	Capt. A. N. Lee, U. S. Lake S. At Fort Porter.
6	1873, June 3, 6.	74 29	0·1691	0·6320	“ “ “ “ “ “
7	1885, Sept. 17, 18, 19.	74 04·7	0·1692	0·6168	J. B. Baylor, U. S. Coast & G. S. At Fort Porter.

Secular variations of the magnetic declination, dip and intensity—Continued.

BUFFALO, N. Y.—Continued.

DIP AND INTENSITY AT BUFFALO—Continued.

$$\Theta = 74^\circ{\cdot}74 + 0{\cdot}010\ 1\ m - 0{\cdot}000\ 756\ m^2$$
$$H = 0{\cdot}167\ 6 - 0{\cdot}000\ 063\ m + 0{\cdot}000\ 003\ 4\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1839·6	74·68	74·55	—0·13
1844·5	74·61	·66	+0·05
1845·8	74·63	·68	+0·05
1859·4	74·78	·77	—0·01
1872·5	74·72	·58	—0·14
1873·4	74·48	·56	+0·08
1885·7	74·08	74·14	+0·06

Date.	Obs'd H.	Comp'd H.	C — O.
1844·5	0·1689	0·1681	—0·0008
1845·8	74	79	+ 05
1859·4	63	73	+ 10
1872·4	80	79	- 01
1873·4	91	80	— 11
1885·7	0·1692	0·1696	+0·0004

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	+0·79	74·24	0·1702	0·6266
1840	1·35	·56	·1684	·6325
1850	2·05	·74	74	·6360
1860	2·84	·77	71	·6362
1870	3·67	·64	75	·6323
1880	4·51	74·36	·1685	·6250
1890	5·30	73·93	·1702	·6149
1900	+6·0	73·35	0·1726	0·6024

ITHACA, N. Y.

$\varphi = 42^\circ\ 26'{\cdot}8 \qquad \lambda = 76^\circ\ 28'{\cdot}9$ W. of Gr.

[Cornell University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1672, June 24.	10 W.	Observer, Father Raffeix. In the country between the lakes, probably in Cayuga County. Approximate position $\varphi = 42\frac{1}{2}^\circ$, $\lambda = 76\frac{3}{4}^\circ$ W. of Gr. Raffeix, writing from Goiougouen, describes the country between the lakes at about $42\frac{1}{2}^\circ$ lat. and notes the magnetic declination as scarcely 10°. Communicated by J. H. Trumbull, April, 1876.
2	1795—	3 25 W.	Benjamin Ellicott ran the new prëemption line, longitude 76° 57′·9 W. from Gr. and in latitude 42° 27′, and found the declination 3° 25′ W. [Platting the observed declinations of the prëemption line (1795), of the Pennsylvania line (1786–87), and of the west boundary of Pennsylvania (1786), and constructing an isogonic chart for the epoch 1790, I find the reduction of Ellicott's station to Ithaca to equal about +35′, hence for 1795 declination at Ithaca, 4°·0 W. — Sch.]
3	1831, Sept.	2 51 W.	Regent's Report, Geological Survey of New York. In $\varphi = 42^\circ\ 27'$, $\lambda = 76^\circ\ 30'$ W. [See also Silliman's Journal, Vol. XXXIV, 1838, where the year 1833 is given to the observation.
4	1874, June 13.	5 25·8 W.	Dr. T. C. Hilgard, at the Fuertes Meridian, Cornell College grounds. Appendix No. 8, C. & G. S. Rept. for 1881. Assigned position $\varphi = 42^\circ\ 27'{\cdot}5$, $\lambda = 76^\circ\ 33'{\cdot}0$ W. of Gr.
5	1889, Apr. 17, 18, 19.	6 25·5 W.	J. C. Dowling and J. F. Hayford; MS. of thesis communicated by Prof. Fuertes. At Cornell University, position as in heading.
6	1890, Oct. 27, 28.	6 31·5 W.	J. B. Baylor, U. S. Coast & G. S. At Cornell University, position as above.

Secular variations of the magnetic declination, dip and intensity—Continued.

ITHACA, N. Y.—Continued.

$D = +6°\cdot48 + 3\cdot74 \sin(1\cdot35m - 52°\cdot4)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1672·5	+10·00		+9·95	—0·05
1795·5	3·42		3·45	+0·03
1831·7	2·85		2·84	—0·01
1874·4	5·43		5·23	—0·20
1889·3	6·42		6·52	+0·12
1890·8	+ 6·53		+6·66	+0·13

DIP AND INTENSITY AT ITHACA.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1874, June 13.	74 14·7	0·1689	0·6221	Dr. T. C. Hilgard.
2	1888, Oct. 9, Nov. 5.	....	0·1713	......	J. C. Dowling and J. F. Hayford. At Cornell University.
3	1889, Apr. 17, 18, 19.	73 51·7	......	......	J. C. Dowling and J. F. Hayford. At Cornell University.
4	1890, Oct. 27, 28.	73 49·5	0·1692	0·6074	J. B. Baylor, U. S. Coast & G. S. At Cornell University.

DUNKIRK, N. Y.

$\varphi = 42° \; 29'\cdot6$ $\lambda = 79° \; 21'\cdot3$ W. of Gr.

[Light-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1798, Aug. 2.	0 35 E.	By a surveyor of the Holland Land Co. At Chautauqua Lake, about 15 statute miles to the southward and westward of Fredonia ($\varphi = 42° \; 26'\cdot5$, $\lambda = 79° \; 21'\cdot5$).
2	1837, June 16 to Aug. 28.	0 37·6 W.	W. L. Starke at Fredonia; mean of 4 morning and 3 evening observations.
3	1841, Aug. 12.	0 52·5 W.	Dr. A. D. Bache, at Dunkirk, in $\varphi = 42° \; 29'\cdot3$, $\lambda = 79° \; 21'$. Appendix No. 19, C. S. Rept. for 1862.
4	1845—	1 07 W.	Lieut. J. H. Simpson at Dunkirk. Prof. Papers No. 24, U. S. E., Washington, D. C., 1882. In $\varphi = 42° \; 30'$, $\lambda = 79° \; 21'$.
5	1850, Aug.	1 20 W.	N. Y. & E. R. R. engineer, at Dunkirk.
6	1874, Aug. 8, 9, 10.	2 57 W.	E. S. Ely, surveyor; letter dated Fredonia, July 6, 1891.
7	1891—	4 12·5 W.	" " " " as above. This letter also refers to the observations of 1798, 1837 and 1850.

$D = +2°\cdot34 + 2\cdot89 \sin(1\cdot40\,m - 19°\cdot8)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1798·6	—0·58		—0·55	+0·03
1837·6	+0·63		+0·59	—0·04
1841·6	+0·88		+0·83	—0·05
1845·5	+1·12		+1·07	—0·05
1850·6	+1·33		+1·40	+0·07
1874·6	+2·95		+3·07	+0·12
1891·5	+4·21		+4·13	—0·08

DIP AND INTENSITY AT DUNKIRK.

No.	Date.	θ.	H.	F.	Reference.
		° ′			
1	1841, Aug.	74 17·2	0·1670	0·6166	Dr. A. D. Bache.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

DETROIT, MICH.

$\varphi = 42° 20'.0$ $\lambda = 83° 03'.0$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1810—	2 48 E.	J. Mansfield.
2	1822—	3 13 E.	L. Lyons.
3	1828—	2 50 E.	
4	1835—	2 10 E.	Geological Report.
5	1839, July.	1 34 E.	W. A. Burt, near Detroit in $\varphi = 42° 42'$, $\lambda = (?)$. Letter of C. S. Woodard dated Ypsilanti, Sept. 10, 1888.
6	1840—	2 00 E.	Geological Report.
	1840—	1 56 E.	Prof. E. Loomis.
7	1859, Apr.	0 42 E.	U. S. Lake S.
8	1865—	0 40 E.	
9	1872, May 8–29.	0 25.2 E.	Capt. A. N. Lee, U. S. Lake S.
10	1873, May 5–17.	0 17.3 E.	
11	1876, June 3, 6.	0 04.7 E.	Lieut. T. N. Bailey, U. S. Lake S.
12	1885, Sept. 2, 3, 4.	0 31.0 W.	J. B. Baylor, U. S. Coast & G. S. In rear of Harper Hospital.
13	1891, June 20–26.	1 00.0 W.	G. R. Putnam, U. S. Coast & G. S. At Olympic Park in $\varphi = 42° 21'.1$, $\lambda = 83° 03'.4$; result referred to mean of day.

$$D = -0°.72 + 2.42 \sin (1.40\, m - 19°.0)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°
1810.5	—2.80		—3.05	—0.25
1822.5	3.22		2.76	+0.46
1828.5	2.83		2.55	+0.28
1835.5	2.17		2.25	—0.08
1839.5	1.57		2.06	—0.49
1840.5	1.97		2.01	—0.04
1859.3	0.70		0.97	—0.27
1865.5	0.67		0.61	+0.06
1872.4	0.42		0.20	+0.22
1873.4	0.29		—0.14	+0.15
1876.4	—0.08		+0.03	+0.11
1885.7	+0.52		+0.53	+0.01
1891.5	+1.00		+0.80	—0.20

DIP AND INTENSITY AT DETROIT.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1839, May.	73 42.6	......	......	Prof. E. Loomis.
2	1841, Aug.	73 35.7	......	......	" " "
	1841, Sept.	73 32.7	......	......	" J. N. Nicollet.
3	1842, Nov. 4.	73 28.7	......	0.6372	Lieut. C. Younghusband.
4	1843, June 12, 15.	73 32.2	0.1795	0.6331	Dr. J. Locke.
5	1845—	73 38.8	......	0.6326	Sir J. H. Lefroy.
6	1859, Apr.	73 41	0.1776	0.6321	Lieut. W. P. Smith, U. S. Lake S.
7	1860, May.	73 43	0.1782	0.6356	" " " " " " "
8	1872, May 8–29.	73 35	0.1789	0.6326	Capt. A. N. Lee, " " "
9	1873, May 5–16.	73 34	0.1789	0.6324	" " " " " " "
10	1876, May and June.	73 34.1	0.1797	0.6354	Lieut. T. N. Bailey, " " "
11	1885, Sept. 2, 3, 4.	73 12.8	0.1792	0.6204	J. B. Baylor, U. S. Coast & G. S. In rear of Harper Hospital.
12	1891, June 20, 21, 22.	73 05.9	0.1803	0.6201	G. R. Putnam, U. S. Coast & G. S. At Olympic Park.

Secular variations of the magnetic declination, dip and intensity—Continued.

DETROIT, MICH.—Continued.

DIP AND INTENSITY AT DETROIT—Continued.

$$\Theta = 73^\circ{\cdot}67 + 0{\cdot}008\ 41\ m - 0{\cdot}000\ 545\ m^2$$
$$H = 0{\cdot}178\ 7 - 0{\cdot}000\ 054\ m + 0{\cdot}000\ 002\ 2\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1839·4	73·71	73·52	—0·19
1841·7	·57	·56	— ·01
1842·8	·48	·58	+ ·10
1843·4	·54	·59	+ ·05
1845·5	·65	·62	— ·03
1859·3	·68	·70	+ ·02
1860·4	·72	·70	— ·02
1872·4	·58	·58	·00
1873·4	·57	·57	·00
1876·4	·57	·51	— ·06
1885·7	·21	·28	+ ·07
1891·5	73·10	73·08	— ·02

Date.	Obs'd H.	Comp'd H.	C—O.
1843·4	0·1795	0·1792	—0·0003
1859·3	76	84	+ 8
1860·4	82	84	+ 2
1872·4	89	86	— 3
1873·4	89	87	— 2
1876·4	97	88	— 9
1885·7	0·1792	0·1796	+ 4
1891·5	0·1803	0·1803	0·0000

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	—2·49	73·28	0·1807	0·6281
1840	2·04	·53	795	331
1850	1·55	·67	87	354
1860	0·93	·70	84	356
1870	—0·34	·62	85	330
1880	+0·23	·43	791	281
1890	+0·74	73·13	801	209
1900	+1·2	72·73	0·1816	0·6117

KALAMAZOO, MICH.

$\varphi = 42^\circ\ 17'{\cdot}4$ $\lambda = 85^\circ\ 35'{\cdot}2$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1826—	5 50 E.	From General Land Office record; letter of Acting Commissioner of Dec. 13,1879. In $\varphi = 42^\circ\ 30'$, $\lambda = 85^\circ\ 48'$, this is to the north and west of Kalamazoo, while Bronson is south and east of the same. The reduction to either place is small and covered by the observing error.
2	1834—	{6 45 E. {4 52 E.	From a map entitled "Plat of the village of Bronson, county seat of Kalamazoo County; L. Lyon, T. Bronson, J. Burdick, and T. C. Sheldon, proprietors [used mean value = —5°·81. Sch.].
3	1879, Apr.	3 13 E.	Frank Hodgeman, surveyor, Kalamazoo Weekly Telegraph, Dec. 29, 1880.
4	{1880, Sept. {1880, Dec. 21.	{2 45 E. {2 46 E.	Reference as above. Marcus Baker, U. S. Coast & G. S.
5	1884, Aug. 22, 23.	2 47 E.	" " " " " "
6	1890, July 3.	1 55 E.	" " " Geological S.; letter of July 14, 1890.
7	1893, Aug. 1.	1 43 E.	" " " " " " Aug. 24, 1893.
8	1895, Sept. 23.	1 32 E.	" " " " " At Lake Survey astronomical post in City Park.

Secular variations of the magnetic declination, dip and intensity—Continued.

KALAMAZOO, MICH.—Continued.

$D = -1^\circ{\cdot}63 + 4{\cdot}21 \sin(1{\cdot}4\, m - 61^\circ{\cdot}6)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1826·0	−5·83		−5·82	+0·01
1834·0	5·81		5·82	−0·01
1879·3	3·22		3·11	+0·11
1880·8	2·76		2·96	−0·20
1884·6	2·78		2·59	+0·19
1890·5	1·92		1·99	−0·07
1893·6	1·72		1·68	+0·04
1895·7	−1·53		−1·46	+0·07

DIP AND INTENSITY AT KALAMAZOO.

(No observations here.)

YPSILANTI, MICH.

$\varphi = 42^\circ\ 14'{\cdot}3 \qquad \lambda = 83^\circ\ 37'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1815—	4 00 E.	Government land surveyors.
2	1825—	3 16 E.	W. Brookfield.
3	1832—	2 40 E.	O. Risdon.
4	1838—	2 25 E.	" "
5	1851—	1 12 E.	C. S. Woodard.
6	1855, Jan. 10.	1 00 E.	C. S. Woodard.
7	1859, Feb. 26.	0 45 E.	C. S. Woodard.
8	1860, June 11.	0 38 E.	C. S. Woodard.
9	1863—	0 25 E.	C. S. Woodard.
10	1875, Dec. 4.	0 30 W.	C. S. Woodard.
11	1878—	0 45 W.	C. S. Woodard.
12	1881, Mar. 11.	1 00 W.	C. S. Woodard.
13	1885, Aug. 18.	1 13 W.	C. S. Woodard.
14	1887, Apr. 25.	1 25 W.	C. S. Woodard.
15	1888, Aug. 23.	{1 30 W. 1 40 W.}	C. S. Woodard. When referred to mean of day + 1°·50.
16	1893, Aug. to Dec.	2 18 W.	C. S. Woodard. Observations at several hours each day. Letter of Jan. 1, 1894.
17	1894, Jan. to Dec.	2 08 W.	C. S. Woodard. Letter of Jan. 3, 1895.
18	1895, Jan. to Dec.	2 07 W.	" " " " Jan. 2, 1896.

$D = -0^\circ{\cdot}76 + 3{\cdot}59 \sin(1{\cdot}35\, m - 11^\circ{\cdot}8)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1815·5	−4·00		−3·82	+0·18	1875·9	+0·50		+0·65	+0·15
1825·5	3·27		3·29	−0·02	1878·5	0·75		0·85	+0·10
1832·5	2·67		2·84	−0·17	1881·2	1·00		1·05	+0·05
1838·5	2·42		2·40	+0·02	1885·6	1·22		1·36	+0·14
1851·5	1·20		1·37	−0·17	1887·3	1·42		1·48	+0·06
1855·0	1·00		1·07	−0·07	1888·6	1·50		1·56	+0·06
1859·1	0·75		0·73	+0·02	1893·8	2·30		1·88	−0·42
1860·4	0·63		0·62	+0·01	1894·5	2·13		1·92	−0·21
1863·5	−0·42		−0·36	+0·06	1895·5	+2·12		+2·03	−0·09

DIP AND INTENSITY AT YPSILANTI.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1839, May.	73 18	......	......	Prof. E. Loomis.
2	1841, Aug.	73 18·8	......	......	" " "

Secular variations of the magnetic declination, dip and intensity—Continued.

ERIE, PA.

$\varphi = 42° 07'.8$ $\lambda = 80° 05'.4$ W. of Gr.

[Court-house.]

No.	Date.	D.		References and remarks.
		° ′		
1	1786, Oct.	0 32	W.	Boundary monument on French Creek, about 10 miles SSE. of Erie.
2	1793—	0 42	E.	Report of Secretary of Internal Affairs, Pa. 1885.
3	1795—	0 43	E.	A. Ellicott. Monument corner Parade and Front streets.
4	1841, Aug.	0 30	W.	Dr. A. D. Bache. Near Reed's house.
5	1855—	1 33	W.	Report of Secretary of Internal Affairs, Pa. 1877.
6	1859, Apr.	1 34	W.	S. Low. At meridian in cemetery.
	1859, June.	1 44	W.	Lieut. W. P. Smith, U. S. Lake S. At Presque Isle Harbor.
7	1862, Aug. 6, 7.	1 33	W.	C. A. Schott, U. S. Coast S. Seventh street near Reed's house.
	1862—	1 30	W.	S. Low.
8	1867, Apr.	2 13	W.	S. Wilson. At meridian in cemetery.
9	1873, June 12, 13.	2 01	W.	Capt. A. N. Lee, U. S. Lake S.
	1873, Oct.	2 36	W.	S. Wilson. At meridian in cemetery.
10	1875, Oct. 9.	2 10	W.	A. C. Lamson.
11	1876—	2 50	W.	Report of Secretary of Internal Affairs, Pa. 1876.
12	1877, Nov.	3 00	W.	" " " " " " 1877.
13	1883, Nov. 9.	3 20	W.	Platt. Report of Secretary of Internal Affairs, Pa. 1885.
14	1885, Sept. 11, 12, 14.	3 08.2	W.	J. B. Baylor, U. S. Coast & G. S. At Marine Hospital.

$$D = +2°.17 + 2.69 \sin (1.5\, m - 27°.3)$$

Date.	Obs'd D. *p*.	Comp'd D.	C — O.	Date.	Obs'd D. *p*.	Comp'd D.	C — O.
	°	°	°		°	°	°
1786.8	+0.53	—0.11	—0.64	1867.3	+2.22	+2.11	—0.11
1793.5	—0.70	—0.32	+0.38	1873.6	2.31	2.55	+0.24
1795.5	—0.72	—0.37	+0.35	1875.8	2.17	2.70	+0.53
1841.6	+0.50	+0.45	—0.05	1876.5	2.83	2.75	—0.08
1855.5	1.55	1.29	—0.26	1877.9	3.00	2.84	—0.16
1859.4	1.65	1.56	—0.09	1883.9	3.33	3.24	—0.09
1862.6	+1.53	+1.78	+0.25	1885.7	+3.14	+3.36	+0.22

DIP AND INTENSITY AT ERIE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1841, Aug.	73 46.6	0.1748	0.6256	Dr. A. D. Bache.
2	1859, June 7.	73 56	0.1744	0.6299	Lieut. W. P. Smith, U. S. Lake S.
3	1862, Aug. 6, 7.	73 52.3	0.1734	0.6243	C. A. Schott, U. S. Coast S.
4	1873, June 11, 12.	73 46	0.1765	0.6315	Capt. A. N. Lee, U. S. Lake S.
5	1885, Sept. 11, 12, 14.	73 24.3	0.1764	0.6180	J. B. Baylor, U. S. Coast & G. S. At Marine Hospital.

$$\Theta = 73°.89 + 0.013\,85\, m - 0.000\,786\, m^2$$
$$H = 0.174\,3 - 0.000\,018\, m + 0.000\,002\,5\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C — O.
	°	°	
1841.6	73.78	73.72	—0.06
1859.4	73.93	73.95	+0.02
1862.4	73.87	73.91	+0.04
1873.4	73.77	73.78	+0.01
1885.7	73.40	73.38	—0.02

Date.	Obs'd H.	Comp'd H.	C — O.
1841.6	0.1748	0.1746	—0.0002
1859.4	44	44	00
1862.4	34	45	+ 11
1873.4	65	52	— 13
1885.7	0.1764	0.1768	+0.0004

Secular variations of the magnetic declination, dip and intensity—Continued.

ERIE, PA.—Continued.

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1840	+0·36	73·67	0·1747	0·6213
1850	0·94	·89	43	282
1860	1·60	·95	44	307
1870	2·30	·85	49	288
1880	2·99	·60	60	233
1890	3·62	73·19	76	141
1900	+4·2	72·62	0·1796	0·6012

CHICAGO, ILL.

$\varphi=41° 50'·0$ $\lambda=87° 36'·8$ W. of Gr.

[Observatory, Dearborn University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1823—	6 12 E.	Maj. S. H. Long, U. S. A.
2	1857, July 23.	5 46 E.	Lieut. Col. J. D. Graham.
3	1878, Sept. 2.	4 33 E.	Dr. T. E. Thorpe. Grounds of Chicago University (old site).
4	1888, Aug. 18, 20.	4 07·4 E.	J. B. Baylor, U. S. Coast & G. S. Grounds of Chicago University (old site).
5	1891, July 18, 19, 20.	3 32·3 E.	G. R. Putnam, U. S. Coast & G. S. Near water tower, $\varphi=41°$ $53'·9$, $\lambda=87°$ $37'·4$.

$$D=-3°·40+2·89 \sin (1·45\ m-66°·2)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1823·5	—6·20		—6·20	0·00
1857·6	5·77		5·77	0·00
1878·7	4·55		4·60	—0·05
1888·6	4·12		3·91	+0·21
1891·5	—3·54		—3·70	—0·16

DIP AND INTENSITY AT CHICAGO.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	{ 1841, Sept.	72 45·8	......	......	Prof. J. N. Nicollet.
	{ 1841, Sept.	72 47·8	......	......	Prof. E. Loomis.
2	1842, Nov. 15, 16.	72 39·3	0·1893	0·6353	Lieut. C. Younghusband.
3	1878, Sept. 2.	72 39·4	0·1875	0·6291	Dr. T. E. Thorpe. Grounds of Chicago University (old site).
4	1888, Aug. 18, 20.	72 28·5	0·1863	0·6184	J. B. Baylor, U. S. Coast & G. S. Grounds of Chicago University (old site).
5	1891, July 18, 19, 20.	72 22·6	0·1874	0·6189	G. R. Putnam, U. S. Coast & G. S. Near water tower.

Secular variations of the magnetic declination, dip and intensity—Continued.

CHICAGO, ILL.—Continued.

DIP AND INTENSITY AT CHICAGO—Continued.

$$\Theta = 72°.74 - 0.000\ 34\ m - 0.000\ 167\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1841·7	72·78	72·73	—0·05
1842·9	·66	·73	+0·07
1878·7	·66	·59	—0·07
1888·6	·48	·48	0·00
1891·5	72·38	72·44	+0·06

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1840	—6·25	72·72
1850	6·04	·74
1860	5·67	·73
1870	5·15	·68
1880	4·52	·60
1890	3·81	·49
1900	—3·1	72·34

MICHIGAN CITY, IND.

$\varphi = 41° 43'.4$ $\lambda = 86° 54'.4$ W. of Gr.

[Light-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1830—	5 35 E.	Government land surveys.
2	1857, May 7 to Dec. 31.	3 43 E.	C. S. Woodard.
3	1859, Aug. 28.	5 23 E.	Lieut. W. P. Smith, U. S. Lake Survey.
4	1871, Sept. 11.	4 02 E.	L. Foote.
5	1873, Aug. 25, 26.	3 59 E.	Capt. A. N. Lee, U. S. Lake S. North of north corner of light-house inclosure.
6	1891, July 18.	2 20·1 E.	J. B. Baylor, U. S. Coast & G. S. North of north corner of light-house inclosure.

$D = -2°.38 + 3.12 \sin(1.4\ m - 59°.9)$. An approximate expression.

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°
1830·5	—5·58		—5·50	+0·08
1857·7	3·72		4·74	—1·02
1859·7	5·38		4·63	+0·75
1871·7	4·03		3·91	+0·12
1873·6	3·98		3·79	+0·19
1891·5	—2·34		—2·48	—0·14

DIP AND INTENSITY AT MICHIGAN CITY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1859, Aug. 28.	73 02	0·1853	0·6358	Lieut. W. P. Smith, U. S. Lake S.
2	1873, Aug. 25, 26.	72 43	0·1886	0·6349	Capt. A. N. Lee, U. S. Lake S. North of north corner of light-house inclosure.
3	1891, July 18.	72 25·4	0·1875	0·6210	J. B. Baylor, U. S. Coast & G. S. North of north corner of light-house inclosure.

Secular variations of the magnetic declination, dip and intensity—Continued.

MICHIGAN CITY, IND.—Continued.

DIP AND INTENSITY AT MICHIGAN CITY—Continued.

$\Theta = 73^{\circ}.20 - 0.019\, m$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1859·6	73·03	73·02	—0·01
1873·6	72·72	72·75	+0·03
1891·5	72·42	72·41	—0·01

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1850	—5·1	73·20
1860	4·6	73·01
1870	4·03	72·82
1880	3·34	72·63
1890	2·59	72·44
1900	—1·8	72·25

CLEVELAND, OHIO.

$\varphi = 41^{\circ}\ 30'.4 \qquad \lambda = 81^{\circ}\ 41'.5$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1796, Sept.	2 E.	A. Porter and S. Pease.
2	1830—	1 20 E.	A. Merchant.
3	1831, Aug.	1 15 E.	E. Foote.
4	1834, winter.	0 50 E.	A. Merchant.
5	1838, "	0 35 E.	A. Merchant.
6	1840—	0 19 E.	Prof. E. Loomis.
7	1841, May 1.	0 05 E.	J. N. Pillsbury.
8	1845—	0 39 E.	Chart of N. and NW. Lake S.
9	1859, July 5.	0 46 W.	Lieut. W. P. Smith, U. S. Lake S.
	1865, May 22.	1 12 E.	W. T. Casgrain. Not used. At east end of pier.
10	1871, Nov. 9-11.	0 33 W.	E. Goodfellow, U. S. Coast S. At Marine Hospital.
11	1872, June 17, 18.	0 45 W.	Capt. A. N. Lee, U. S. Lake S.
12	1873, June 16, 17.	0 51 W.	" " " " " " " "
13	1876, Oct. 27, 28.	1 08 W.	A. C. Lamson.
14	1880, July 9, 10, 12.	1 38·5 W.	J. B. Baylor, U. S. Coast & G. S. Grounds of City Hospital.
15	1888, July 23, 24.	2 03·7 W.	" " " " " " " " " "
16	1891, May 30, 31, June 1.	2 19 W.	H. F. Reid, in City Hospital grounds, station of 1871. Record in C. & G. S. archives.

$D = +0^{\circ}.77 + 2.53 \sin (1.30\, m - 21^{\circ}.6).$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1796·7	—2·00		—1·76	+0·24	1859·5	+0·77		+0·37	—0·40
1830·5	1·33		1·08	+0·25	1871·8	0·54		1·07	+0·53
1831·6	1·25		1·03	+0·22	1872·5	0·75		1·10	+0·35
1834·1	0·83		0·93	—0·10	1873·5	0·85		1·16	+0·31
1838·1	0·58		0·76	—0·18	1876·8	1·13		1·35	+0·22
1840·5	0·32		0·64	—0·32	1880·5	1·64		1·55	—0·09
1841·3	0·09		0·60	—0·51	1888·6	2·06		1·98	—0·08
1845·5	—0·65		—0·40	+0·25	1891·4	+2·32		+2·12	—0·20

Secular variations of the magnetic declination, dip and intensity—**Continued.**

CLEVELAND, OHIO—Continued.

DIP AND INTENSITY AT CLEVELAND.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1839, May.	73 26	......	......	Prof. E. Loomis.
2	1840—	73 14·1	......	......	" " "
3	1841 { Aug. / Apr.	73 04·3 / 73 16·3 }	......	......	" " " April obs'n at Brooklyn.
4	1842, Nov. 3.	73 03·8	0·1836	0·6301	Lieut. C. Younghusband. Near landing.
5	1843, Aug. 4.	73 08	0·1847	0·6363	Dr. J. Locke.
6	1859, July 4.	73 20	0·1824	0·6360	Lieut. W. P. Smith, U. S. Lake S. [Not used.] Near Marine and City Hospital.
7	1871, Nov. 6–14.	73 09·3	0·1844	0·6363	E. Goodfellow, U. S. Coast S. Near Marine and City Hospital.
8	1872, June 17, 18.	73 07	0·1852	0·6378	Capt. A. N. Lee, U. S. Lake S. Near Marine and City Hospital.
9	1873, June 16, 17.	73 08	0·1842	0·6350	Capt. A. N. Lee, U. S. Lake S. Near Marine and City Hospital.
10	1880, July 9, 12.	73 02·4	0·1842	0·6317	J. B. Baylor, U. S. Coast & G. S. Near Marine and City Hospital.
11	1888, July 23, 24.	72 49·9	0·1832	0·6208	J. B. Baylor, U. S. Coast & G. S. Near Marine and City Hospital.
12	1891, Apr. 6, May 26, 31, June 1.	72 39	0·183	0·614	H. F. Reid. City Hospital grounds.

$$\Theta = 73^\circ{\cdot}26 + 0{\cdot}002\,4\,m - 0{\cdot}000\,372\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C — O.
	°	°	°
1839·4	73·43	73·19	—0·24
1840·5	·23	·20	—0·03
1841·5	·17	·21	+0·04
1842·8	·06	·22	+0·16
1843·6	·13	·23	+0·10
1871·9	·16	·14	—0·02
1872·5	·12	·13	+0·01
1873·5	·13	73·11	—0·02
1880·5	73·04	72·99	—0·05
1888·6	72·83	72·80	—0·03
1891·4	72·65	72·72	+0·07

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1830	—1·10	73·06
1840	0·66	·20
1850	—0·16	·26
1860	+0·39	·25
1870	0·96	·16
1880	1·52	73·00
1890	2·05	72·76
1900	+2·5	72·45

OMAHA, NEBR.

$\varphi = 41^\circ\ 15'{\cdot}7$ $\lambda = 95^\circ\ 56'{\cdot}5$ W. of Gr.

[High School grounds.]

No.	Date.	D.	References and remarks.
		° ′	
1	1819, Sept. 22.	12 59 E.	Maj. S. H. Long, U. S. A. At Engineer's cantonment; reduction −12′.
2	1869, Jan. 25–27. Feb. 12, 13.	10 43 E.	E. Goodfellow, U. S. Coast S. At Coast Survey astronomic station.
3	1872, Oct. 31.	10 44 E.	Dr. T. C. Hilgard. At Coast Survey astronomic station.
4	1877, Oct. 13–18.	10 22 E.	A. Braid, U. S. Coast S. At Coast Survey astronomic station.
5	1878, Aug. 30.	10 40 E.	Dr. T. E. Thorpe. At Council Bluffs.
6	1880, Oct. 15, 17.	10 06·2 E.	} J. B. Baylor, U. S. Coast & G. S. Grounds of High School.
7	1888, Sept. 25, 26.	9 29·6 E.	}
8	{ 1891, Aug. 30, 31, Sept. 1.	9 23·5 E.	G. R. Putnam, U. S. Coast & G. S. Grounds of High School.
	{ 1891, Sept. 2, 3, 4.	9 37·8 E.	" " " " " " " " " New station N. of above.

***Secular variations of the magnetic declination, dip and intensity*—Continued.**

OMAHA, NEBR.—Continued.

$$D = -9^{\circ}\cdot61 + 3\cdot03 \sin (1\cdot30\, m - 50^{\circ}\cdot9)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1819·7	—12·78	¼	—12·64	+0·14
1869·1	10·71		10·94	—0·23
1872·8	10·74		10·71	+0·03
1877·8	10·37		10·39	—0·02
1878·7	10·66		10·32	+0·34
1880·8	10·10		10·18	—0·08
1888·7	9·49		9·64	—0·15
1891·7	— 9·51		— 9·43	+0·08

DIP AND INTENSITY AT OMAHA.

No.	Date.	Θ.	H.	F.	References.	
		° ′				
1	1869, Jan. 25, Feb. 1.	71 04·5	0·1989	0·6132	E. Goodfellow, U. S. Coast S.	At U. S. C. S. astronomic station.
2	1872, Oct. 31.	71 06·1	0·1992	0·6150	Dr. T. C. Hilgard.	
3	1877, Oct. 13–20.	71 05·8	0·2032	0·6274	A. Braid, U. S. Coast S.	
4	1880, Oct. 15, 17.	71 05·9	0·2017	0·6226	J. B. Baylor, U. S. Coast & G. S.	In grounds of High School.
5	1888, Sept. 25, 26.	71 01·0	0·1996	0·6137	" " " " " " " "	
6	1891, Aug. 30, 31, Sept. 1.	70 47·1	0·2014	0·6120	G. R. Putnam, " " " " "	

BEAVER, PA.

$\varphi = 40^{\circ}\ 44'$ $\lambda = 80^{\circ}\ 20'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1786—	0 51 E.	A. Ellicott. Reduction to Beaver + 8′.
2	1866, Aug. 7, 8.	0 37 W.	F. H. Agnew.
3	1874, Aug. 11.	1 08 W.	F. E. Hilgard.
4	1879—	1 31 W.	Report of Secretary of Internal Affairs, Pa., for 1885. Reduction to Beaver + 5′.
5	1883, Sept. 28.	1 42 W.	County Surveyor.

$$D = +1^{\circ}\cdot41 + 2\cdot72 \sin (1\cdot40\, m - 39^{\circ}\cdot6)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1786·5	—0·72		—0·72	0·00
1866·6	+0·62		+0·64	+0·02
1874·6	1·14		1·17	+0·03
1879·5	1·60		1·49	—0·11
1883·7	+1·70		+1·77	+0·07

DIP AND INTENSITY AT BEAVER.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1839, Oct.	72 40·3	......	......	Prof. E. Loomis.
2	1874, Aug. 11.	72 31·5	0·1870	0·6228	F. E. Hilgard and W. Diehl.

Secular variations of the magnetic declination, dip and intensity—Continued.

PITTSBURG, PA.

$\varphi = 40° 27'.6$ $\lambda = 80° 00'.8$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1840, Aug. 10.	0 08 W.	Dr. A. D. Bache. At Homestead.
2	1845, May 3.	0 33 W.	Dr. J. Locke.
3	1878, Sept. 5.	2 22 W.	Dr. T. E. Thorpe. Grounds of Allegheny Observatory.
4	1884, Sept. 26.	2 41 W.	Hemmings.
5	1885, Aug. 24, 25, 26.	2 55.7 W.	J. B. Baylor, U. S. Coast & G. S. Grounds of Allegheny Observatory.
6	1887, Sept.	3 01 W.	D. Carthart's "Treatise on Plane Surveying," 1888.

$$D = +1°.85 + 2.45 \sin(1.45\, m - 28°.4)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°
1840.6	+0.13		+0.21	+0.08
1845.3	0.55		0.44	—0.11
1878.7	2.36		2.41	+0.05
1884.7	2.68		2.76	+0.08
1885.6	2.93		2.82	—0.11
1887.7	+3.02		+2.93	—0.09

DIP AND INTENSITY AT PITTSBURG.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1819, May 1.	78 12(?)	......	......	Maj. S. H. Long, U. S. A. Possibly misprint for 73° 12′ (Sch.).
2	1839, Sept.	72 38.9	......	......	Prof. E. Loomis.
3	1840, Aug.	72 32.1	0.1867	0.6221	Dr. A. D. Bache. At Homestead.
4	1841, Mar. 22.	72 43.5	0.1872	0.6303	Dr. J. Locke.
5	1842, Apr. 7.	72 43.2	0.1870	0.6298	" " "
6	1845, May 3.	72 46.7	0.1860	0.6282	" " "
7	1878, Sept, 5.	72 07.5	0.1904	0.6203	Dr. T. E. Thorpe. Grounds of Allegheny Observatory.
8	1885, Aug. 24, 26, 27.	72 09.4	0.1870	0.6103	J. B. Baylor, U. S. Coast & G. S. Grounds of Allegheny Observatory.

$$H = 0.188\,9 + 0.000\,213\, m - 0.000\,006\,8\, m^2$$

Date.	Obs'd H.	Comp'd H.	C—O.
1840.6	0.1867	0.1863	—0.0004
1841.2	872	65	— 07
1842.3	870	68	— 02
1845.3	860	77	+ 17
1878.7	904	94	— 10
1885.7	0.1870	0.1878	+0.0008

Secular variations of the magnetic declination, dip and intensity—Continued.

DENVER, COLO.

$\varphi = 39° 45'.3$ $\lambda = 104° 59'.5$ W. of Gr.

[Astronomic station.]

No.	Date.	D.	References and remarks.
		° ′	
1	1866, July.	15 E.	J. Prince.
2	1872, Oct. 13, 14, 19.	14 45 E.	Dr. T. C. Hilgard. On Pierce's Block.
3	1873, Aug. 14.	14 42·8 E.	E. Smith, U. S. Coast S. At U. S. Coast S. astronomic station.
4	{ 1878, Aug. 8.	{ 14 43 E.	Dr. T. E. Thorpe. In Mrs. Craig's garden.
	{ 1878, Sept. 3, 4, 5.	{ 14 40·2 E.	J. B. Baylor, U. S. Coast & G. S. Corner of Seventeenth street and Broadway.
5	1888, Oct. 29, 30.	14 06·1 E.	J. B. Baylor, U. S. Coast & G. S. In grounds of State Capitol.

$$D = -15°.30 + 0.011\, m + 0.000\,5\, m^2$$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1866·5	—15·00		—14·98	+0·02
1872·8	14·74		14·79	—0·05
1873·6	14·71		14·76	—0·05
1878·6	14·70		14·58	+0·12
1888·8	—14·10		—14·12	—0·02

DIP AND INTENSITY AT DENVER.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1872, Oct. 13, 14, 19.	67 34·4	......	......	Dr. T. C. Hilgard. On Pierce's Block.
2	1873, Aug. 13, 14, 15.	67 27·2	0·2299	0·5995	E. Smith, U. S. Coast S. Astronomic station.
3	{ 1878, Aug. 8.	{ 67 32·8	0·2298	0·6018	Dr. T. E. Thorpe. Craig's garden.
	{ 1878, Sept. 3–6.	{ 67 30·7	0·2291	0·5989	J. B. Baylor, U. S. Coast & G. S. Corner Seventeenth street and Broadway.
4	1888, Oct. 29, 30, 31.	67 27·7	0·2269	0·5921	J. B. Baylor, U. S. Coast & G. S. State Capitol grounds.

MARIETTA, OHIO.

$\varphi = 39° 25'$ $\lambda = 81° 28'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1810—	2 36 E.	J. Mansfield.
2	1823–24.	3½ E.	Boye. At Parkersburg, reduction to Marietta +5′.
3	{ 1838—	{ 1 29 E.	Prof. E. Loomis.
	{ 1838—	{ 1 36 E.	B. E. Stone.
4	1845, Apr.	2 25 E.	Henck's Field Book.
5	1850—	1 25 E.	Gillespie's Land surveying.
6	1864, Jan. 26.	1 18 E.	A. T. Mosman, U. S. Coast S., at Parkersburg. Reduction as above.
7	1881, May 30, 31.	0 07·2 W.	J. B. Baylor, U. S. Coast & G. S. Station of 1864.

Secular variations of the magnetic declination, dip and intensity—Continued.

MARIETTA, OHIO—Continued.

$D = +0^\circ{\cdot}02 + 2{\cdot}89 \sin(1{\cdot}4\, m - 40^\circ{\cdot}5)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1810·5	—2·60		—2·86	—0·26
1824·0	3·42		2·79	+0·63
1838·5	1·54	½	2·39	—0·85
1845·3	2·42		2·10	+0·32
1850·5	1·42		1·83	—0·41
1864·1	—1·21		—1·01	+0·20
1881·4	+0·20		+0·20	0·00

DIP AND INTENSITY AT MARIETTA.

No.	Date.	Θ.	H.	F.	Reference.
		° ′			
1	1845--	71 22·3	0·2006	0·6280	Dr. J. Locke.

ATHENS, OHIO.

$\varphi = 39^\circ\ 19'$ $\lambda = 82^\circ\ 02'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1796—	4 03 E.	Public surveys.
2	1806—	4 17 E.	S. B. Pruden and Fletcher, deduced value.
3	1838—	3 12 E.	S. B. Pruden.
4	1880, Dec. 3, 4.	0 40·5 E.	J. B. Baylor, U. S. Coast & G. S. West of College.
5	1890, Dec. 5.	0 05 E.	W. E. Peters, County Surveyor. Letter of Dec. 8, 1890. Observed at 8h a. m. [Reduction to mean of day—2′. Sch.]
6	1891, June 12.	0 00	Prof. W. Hoover; letter of June 13, 1891.

$D = -1^\circ{\cdot}51 + 2{\cdot}63 \sin(1{\cdot}4\, m - 24^\circ{\cdot}7)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1796·5	—4·05		—4·10	—0·05
1806·5	4·28		4·13	+0·15
1838·5	3·20		3·23	—0·03
1880·8	0·68		0·67	+0·01
1890·9	—0·05		0·09	—0·04
1891·4	0·00		—0·06	—0·06

DIP AND INTENSITY AT ATHENS.

No.	Date.	Θ.	H.	F.	Reference.
		° ′			
1	1880, Dec. 3, 4.	70 58·7	0·2024	0·6210	J. B. Baylor, U. S. Coast & G. S. West of College.

Secular variations of the magnetic declination, dip and intensity—Continued.

CINCINNATI, OHIO.

$\varphi = 39° \; 08'.4 \qquad \lambda = 84° \; 25'.3$ W. of Gr.

[Astronomic Observatory on Mount Lookout.]

No.	Date.	D.	References and remarks.
		° ′	
1	1806—	4 58 E.	Public surveys.
2	1810—	5 E.	J. Mansfield.
3	1840, Jan. 11.	4 46 E.	Dr. J. Locke.
4	1845, Apr.	4 04 E.	
5	1873, Oct. 31.	2 40·8 E.	G. B. Nicholson, 8 miles N. of Cincinnati. Reduction to city, o.
6	1880, Nov. 27, 29, 30.	2 14·4 E.	J. B. Baylor, U. S. Coast and G. S. In grounds of observatory at Mount Lookout.
7	1888, July 28, 30.	1 58·0 E.	

$$D = -2°.59 + 2.43 \sin(1.42\, m - 37°.9)$$

Date.	Obs'd D.	*p.* Comp'd D.	C—O.
	°	°	°
1806·5	—4·97	—4·99	—0·02
1810·5	5·00	5·02	—0·02
1840·0	4·77	4·51	+0·26
1845·3	4·07	4·30	—0·23
1873·8	2·68	3·29	—0·61
1880·9	2·24	2·34	—0·10
1888·6	—1·97	—1·88	+0·09

DIP AND INTENSITY AT CINCINNATI.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1838, Mar. 20.	70 28·1	......	......	Dr. J. Locke.
	1838—	70 46	......	......	" " "
2	1840, Aug. 18, Sept. 24.	70 28·3	......	......	" " "
3	1841, May 8.	70 26·2	......	......	" " "
	1841, Oct.	70 27·7	......	......	Prof. E. Loomis. In Longworth's garden.
4	1842, Mar. 31.	70 25·4	......	......	Dr. J. Locke.
5	1843, Aug. 21.	70 25·5	......	......	" " "
6	1844, Mar. 21.	70 28	0·2097	0·6266	" " "
	1844, July 4.	70 25			" " "
7	1845, Apr. 23.	70 26	0·2097	0·6262	" " "
8	1849, June 5.	70 28·8	0·2087	0·6247	Sir J. H. Lefroy. In Longworth's garden.
9	1880, Nov. 29, 30.	70 24·7	0·2069	0·6172	J. B. Baylor, U. S. Coast & G. S. At observatory, Mount Lookout.
10	1888, July 28, 30.	70 18·7	0·2058	0·6110	

Dip apparently constant between 1838 and 1880.

SAINT LOUIS, MO.

$\varphi = 38° \; 38'.0 \qquad \lambda = 90° \; 12'.2$ W. of Gr.

[Washington University.]

No.	Date.	D.	References and remarks.
		° ′	
	1819, June 17.	10 48 E.	Maj. S. H. Long, U. S. A. Not used.
1	1835—	8 49 E.	Col. Nicolls.
	1838—	7 45 E.	De Ward. On city commons. Not used.
2	1855—	8 00 E.	Colton's Atlas, 1873.
	1856, Oct. 31.	6 23 E.	K. Friesach. Not used.
3	1872, June, July, Aug.	6 38 E.	Dr. T. C. Hilgard. On Compton Hill and SW. of court-house.
4	1877, June.	6 30 E.	T. Featherson.
5	1878, Aug. 14, 15.	6 34 E.	Prof. F. E. Nipher. SE. corner Garrison ave. and Dickson st.
6	1879, Sept.	6 13 E.	Prof. F. E. Nipher. Corner Garrison ave. and Glasgow place.
7	1886, Oct. 3, 4, 5, 6.	6 10·6 E.	C. H. Sinclair, U. S. Coast and G. S. Near Tower Grove Park.

Secular variations of the magnetic declination, dip and intensity—Continued.

SAINT LOUIS, MO.—Continued.

$D = -5^\circ{\cdot}91 + 3{\cdot}00 \sin (1{\cdot}40\, m - 51^\circ{\cdot}1)$. Uncertain.*

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1835·5	—8·82		—8·74	+0·08
1855·5	8·00		7·96	+0·04
1872·6	6·63		6·90	—0·27
1877·5	6·51		6·56	—0·05
1878·6	6·56		6·48	+0·08
1879·7	6·22		6·39	—0·17
1886·8	—6·18		—5·88	+0·30

* But confirmed by an observation in 1896.

DIP AND INTENSITY AT ST. LOUIS.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1819, June 16.	70 30	......	......	Maj. S. H. Long, U. S. A.
2	{ 1835, Aug. 1836, June.	69 10	0·2220	0·6242	Prof. J. N. Nicollet. In H. Chauteau's garden.
3	1839, Sept. 6.	69 31·4	0·2189	0·6261	Dr. J. Locke.
4	{ 1841, Sept.	79 25·5	......	......	Prof. E. Loomis. One mile west of city.
	1841, Oct. 11.	69 27·1	......	......	Prof. J. N. Nicollet. In H. Chauteau's orchard.
5	1856, Nov. 1.	68 01(?)	0·2270	0·6062	K. Friesach.
6	1872, June and July.	69 34·4	0·2134	0·6115	Dr. T. C. Hilgard. On Compton Hill.
7	{ 1878, May 27, 28, 30.	69 18·7	......	......	Prof. F. E. Nipher. In three localities.
	1878, July 10, Oct. 11.	....	0·2115	......	Prof. F. E. Nipher. Washington ave. and Eighteenth st.
8	1879, Sept. 3, 9.	....	0·2155	......	Prof. F. E. Nipher.
9	1886, Oct. 3–7.	69 28·5	0·2157	0·6152	C. H. Sinclair, U. S. Coast & G. S. Near Tower Grove Park.

The dip has remained nearly stationary during the last 60 years.

NASHVILLE, TENN.

$\varphi = 36^\circ\ 08'{\cdot}9 \qquad \lambda = 86^\circ\ 48'{\cdot}2$ W. of Gr.

[Vanderbilt University.]

No.	Date.	D.	References and remarks.
		° ′	
1	1829—	6 50 E.	} Prof. Hamilton.
2	1835—	7 07 E.	
3	1877, Dec. 5, 6, 7.	5 14·9 E.	A. Braid, U. S. Coast S. Grounds of Vanderbilt University.
4	1888, Aug. 7, 8.	4 31·0 E.	J. B. Baylor, U. S. Coast & G. S. Grounds of Vanderbilt University.

$D = -3^\circ{\cdot}57 + 3{\cdot}33 \sin (1{\cdot}35\, m - 68^\circ{\cdot}5)$. Expression uncertain.

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1829·5	—6·83		—6·88	—0·05
1835·5	7·12		6·90	+0·22
1877·9	5·25		5·27	—0·02
1888·6	—4·52		—4·51	+0·01

* But confirmed by an observation in 1896.

Secular variations of the magnetic declination, dip and intensity—Continued.

NASHVILLE, TENN.—Continued.

DIP AND INTENSITY AT NASHVILLE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1833, Nov.	67 05	......	......	J. N. Nicollet.
2	1877, Dec. 5, 6, 7.	67 18·9	0·2356	0·6109	A. Braid, U. S. Coast S. Grounds of Vanderbilt University.
3	1888, Aug. 7, 8.	67 03·9	0·2312	0·5932	J. B. Baylor, U. S. Coast & G. S. Grounds of Vanderbilt University.

FLORENCE, ALA.

$\varphi = 34° 47'{\cdot}2$ $\lambda = 87° 41'{\cdot}7$ W. of Gr.

[Astronomic station.]

No.	Date.	Θ.	References and remarks.
		° ′	
1	1818—	6 35 E.	J. H. Weakly.
2	1835—	6 28 E.	
3	1865, Apr. 17.	5 24 E.	A. T. Mosman, U. S. Coast S. Near railway bridge.
4	1875, May 29.	5 14 E.	F. E. Hilgard. $\varphi = 34° 47'$, $\lambda = 87° 42'$.
5	1881, Sept. 5, 6.	4 37·8 E.	J. B. Baylor, U. S. Coast & G. S. Grounds of Synd'l College for Females. $\varphi = 34° 48'$, $\lambda = 87° 43'$.
6	1890, May 29, 30.	4 15·6 E.	J. B. Baylor, U. S. Coast & G. S. Locality as in 1881. College station.

$$D = -4°{\cdot}25 + 2{\cdot}33 \sin (1{\cdot}3\, m - 52°{\cdot}8)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°
1818·5	—6·58		—6·58	0·00
1835·5	6·47		6·46	+0·01
1865·3	5·40		5·51	—0·11
1875·4	5·24		5·04	+0·20
1881·7	4·63		4·72	—0·09
1890·4	—4·26		—4·26	0·00

DIP AND INTENSITY AT FLORENCE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1881, Sept. 5, 6.	65 52·1	0·2442	0·5974	J. B. Baylor, U. S. Coast & G. S. Synd'l College.
2	1890, May 29, 30.	65 30·6	0·2415	0·5826	J. B. Baylor U. S. Coast & G. S. Synd'l College.

Secular variations of the magnetic declination, dip and intensity—Continued.

MOBILE, ALA.

$\varphi = 30° 41'.4$ $\lambda = 88° 02'.5$ W. of Gr.

[Astronomic station.]

No.	Date.	D.	References and remarks.
		° ′	
	1809—	8 10 E.	J. H. Weakly. Not used.
1	1814—	6 30 E.	Kent.
2	1835—	7 12 E.	J. H. Weakly.
3	1840—	7 05 E.	Chart by E. and G. W. Blunt.
4	1843—	6 56 E.	L. M. Powell, U. S. N. At Mobile Point light.
5	1847, May 21-30.	7 04 E.	R. H. Fauntleroy, U. S. Coast S. At Fort Morgan.
6	1857, Feb. 14-18.	6 52.2 E.	E. Goodfellow, " " " " On public square.
7	1875, May 27.	6 07 E.	J. M. Poole, Summerville.
8	1883, Mar. 12.	5 17 E.	Lieut. E. S. Prime, U. S. N.

$$D = -4°.38 + 2.69 \sin(1.45\, m - 76°.4)^*$$

Date.	Obs'd D.	p.	Comp'd D.	C — O.
	°		°	°
1814.5	—6.50		—6.50	0.00
1835.5	7.20		7.05	+0.15
1840.5	7.08		7.07	+0.01
1843.5	6.93		7.06	—0.13
1847.4	7.07		7.03	+0.04
1857.1	6.87		6.84	+0.03
1875.4	6.12		6.09	+0.03
1883.2	—5.28		—5.66	—0.38

DIP AND INTENSITY AT MOBILE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	{1834 / 1835} May.	61 38	0.2820	0.5935	Prof. J. N. Nicollet. Batre's garden.
2	1857, Feb. 9-25.	60 51.0	0.2836	0.5821	E. Goodfellow, U. S. Coast Survey. Public square.

PENSACOLA, FLA.

$\varphi = 30° 20'.8$ $\lambda = 87° 18'.3$ W. of Gr.

[Light-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1763—	4½ E.	Plan of Pensacola.
2	1775—	4½ E.	Des Barres' Atlantic Neptune.
3	1807—	7 50 E.	V. S. Pintado.
4	1817—	8 45 E.	V. S. Pintado.
5	1835—	6 10 E.	Navy officer.
6	1843—	6 54 E.	L. M. Powell, Comdr. U. S. N. At Navy-Yard.
7	1858, June 21.	6 47 E.	J. J. Oltmanns, U. S. Coast S. On Public Square.
8	1861, Jan. 8, 9.	6 42 E.	G. W. Dean, U. S. Coast S. At Barkley Point.
9	1880, Jan. 1.	5 20 E.	W. H. Davison.
10	1890, Mar.	4 55 E.	W. H. Davison.
11	1895, Mar. 21, 22, 23.	4 43.8 E.	R. L. Faris, U. S. Coast & G. S. At Navy-Yard.

*An observation in 1896 points to $D = -4°.15 + 2.95 \sin(1.42\, m - 74°.5)$ as a preferable expression.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

PENSACOLA, FLA.—Continued.

$D = -4°.58 + 2°.92 \sin (1.4\, m - 61°.4)$

Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°
1763.5	−4.50		−4.45	+0.05
1775.5	4.50		5.30	−0.80
1807.5	7.83		7.09	+0.74
1817.5	8.75		7.37	+1.38
1835.5	6.17		7.47	−1.30
1843.5	6.90		7.33	−0.43
1858.5	6.79		6.80	−0.01
1861.0	6.70		6.68	+0.02
1880.0	5.33		5.53	−0.22
1890.2	4.92		4.84	+0.08
1895.2	−4.73	2	−4.48	+0.25

DIP AND INTENSITY AT PENSACOLA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1858, June 22, 23.	61 05.9	0.2825	0.5845	J. G. Oltmanns and F. H. Gerdes, U. S. Coast S. Public Square.
2	1861, Jan. 5–11.	60 38.9	0.2836	0.5786	G. W. Dean, U. S. Coast S. At Barkley Point.
3	1895, Mar. 21, 22, 23.	60 39.1	0.2685	0.5478	R. L. Faris, U. S. Coast & G. S. At Navy-Yard.

AUSTIN, TEX.

$\varphi = 30° 16'.4$ $\lambda = 97° 44'.2$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1835—	10 E.	General Land Office record.
2	1871, May 4.	9 09.7 E.	J. W. Glenn, letter to Office of May 4, 1871.
3	1872, Mar. 27, Apr. 5, 13, 15.	9 09 E.	W. Eimbeck, U. S. Coast S.
4	1878, June 20, 21, 22.	8 57.5 E.	J. B. Baylor, " " " " On Public Reservation.
5	1889, Sept.	8 20.0 E.	M. J. Doyle, General Land Office.
6	1890, Mar. 19, 20.	8 18.6 E.	J. B. Baylor, U. S. Coast & G. S.
7	1895, May 15, 16, 17.	8 07.0 E.	E. Smith, " " " " " " Grounds of the University. $\varphi = 30° 17'$, $= 97° 44'.2$.

$D = -9°.13 + 0.0466 (t - 1873.0)$

Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°
1835.5	−10.00	0	−10.88	(−0.88)
1871.3	9.16		9.20	−0.04
1872.3	9.15		9.16	−0.01
1878.5	8.96		8.87	+0.09
1889.7	8.33		8.35	−0.02
1890.2	8.31		8.32	−0.01
1895.4	−8.12		−8.08	+0.04

Secular variations of the magnetic declination, dip and intensity—Continued.

AUSTIN, TEX.—Continued.

DIP AND INTENSITY AT AUSTIN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1878, June 21–25.	58 56·7	0·2891	0·5602	J. B. Baylor, U. S. Coast S. On Public Reservation.
2	1890, Mar. 19, 20.	58 51·4	0·2849	0·5509	J. B. Baylor, U. S. Coast & G. S. On Public Reservation.
3	1895, May 15, 16, 17.	58 58·8	0·2833	0·5497	E. Smith, U. S. Coast & G. S. Grounds of University.

NEW ORLEANS, LA.

$\varphi = 29° 57'·2$ $\lambda = 90° 03'·9$ W. of Gr.

[Custom-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700—	3 E.	C. & G. S. Rept. for 1888, p. 306. Deduced from observations at 17 stations.
		2½ E.	Sir E. Halley's Tabula Nautica.
2	1720—	2 E.	Laval.
3	1750—	4 36 E.	C. & G. S. Rept. for 1888, p. 308. Deduced from observations at 19 stations.
	1768—	7 50 E.	Gauld. Not used.
4	1796—	5 06 E.	A. G. Blanchard.
5	1806—	8 03 E.	Lason.
6	1840—	8 20 E.	General Land Office.
7	1856, Dec. 28.	8 00 E.	K. Friesach.
8	1858, Apr. 6, 7.	7 52 E.	G. W. Dean, U. S. Coast Survey. Basin and Canal streets.
9	1870—	7 06 E.	M. J. Thompson.
10	1872, Feb. 10–17.	6 40 E.	Dr. T. C. Hilgard. In City Park.
11	1880, Mar. 24, 25.	6 27.6 E.	J. B. Baylor, U. S. Coast & G. S. Fair Grounds station.
12	1895, July 19, 23, 24.	5 40·4 E.	G. R. Putnam, " " " " " " "

$$D = -5°·20 + 2·98 \sin (1·40\, m - 69°·8)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1700·0	—2·75		—2·26	+0·49	1857·0	—8·00		—7·78	+0·22
1720·5	2·00	½	2·38	—0·38	1858·3	7·86		7·73	+0·13
1750·0	4·60		3·72	+0·88	1870·5	7·10		7·16	—0·06
1796·5	5·10		6·92	—1·82	1872·1	6·66		7·07	—0·41
1806·5	8·05		7·46	+0·59	1880·2	6·46		6·58	—0·12
1840·5	—8·33		—8·16	+0·17	1895·6	—5·67		—5·51	+0·16

On plate A is given a diagram of the representation of the declination observations at this station, from which it will be seen how precarious or rather indefinite the data are upon which the adopted length of the period depends; and it would not be at all surprising if subsequent observations would demand a much longer cycle.

DIP AND INTENSITY AT NEW ORLEANS.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1834, Aug.	60 15	......	......	Prof. J. N. Nicollet.
2	1856, Dec. 18, 24.	59 30	0·2928	0·5769	K. Friesach.
3	1858, Apr. 7, 8, 10.	59 46·5	0·2909	0·5780	G. W. Dean, U. S. Coast S. Basin and Canal streets.
4	1872, Feb. 10, 15.	59 43·5	0·2750(?)	0·5459(?)	Dr. T. C. Hilgard. In City Park.
	1872, Feb. 14.	59 48·6	......	......	" " " " Fair Grounds station.
5	1880, Mar. 24, 25.	59 48·8	0·2838	0·5644	J. B. Baylor, U. S. Coast & G. S. Fair Grounds station.
6	1895, July 19, 23, 24.	59 43·2	0·2794	0·5541	G. R. Putnam, U. S. Coast & G. S. Fair Grounds station.

Secular variations of the magnetic declination, dip and intensity—Continued.

NEW ORLEANS, LA.—Continued.

DIP AND INTENSITY AT NEW ORLEANS—Continued.

$H=0{\cdot}294\,3-0{\cdot}000\,334\,m$

Date.	Obs'd H.	Comp'd H.	C—O.
1857·0	0·2928	0·2920	—0·0008
1858·3	909	915	+ 6
1880·2	838	842	+ 4
1895·6	0·2794	0·2791	—0·0003

SAN ANTONIO, TEX.

$\varphi=29°\ 26'{\cdot}8 \qquad \lambda=98°\ 27'{\cdot}9$ W. of Gr.
$\varphi_{\prime}=29°\ 29'{\cdot}3 \qquad \lambda_{\prime}=98°\ 32'{\cdot}1$ W. of Gr.

[φ Magnetic Observatory, Military Reservation. $\varphi_{\prime}$ Magnetic Observatory, Hillside Ranch.]

No.	Date.	D.	References and remarks.
		° ′	
1	1825—	10½ E.	General Land Office record.
2	1836—	9 45 E.	
3	1874—	9 30 E.	
4	1878, June 10, 11, 12.	9 22·3 E.	J. B. Baylor, U. S. Coast S. Arsenal Grounds. $\varphi=29°\ 25'{\cdot}4$, $\lambda=98°\ 29'{\cdot}3$.
5	1890, Mar. to Dec.	8 53·6 E.	R. E. Halter and L. G. Schultz, U. S. Coast & G. S. Magnetic Observatory, Military Reservation.
6	1891, whole year.	8 48·7 E.	
7	1892, Jan. to Aug.	8 48·5 E.	
	1892, Sept. to Dec.	8 41·8 E.	R. E. Halter and L. G. Schultz, U. S. Coast & G. S. Magnetic Observatory, Hillside Ranch. Reduction to old site at Military Reservation —6′·4, applied.
8	1893, whole year.	8 40·2 E.	
9	1894, " "	8 38·1 E.	
10	1895, Jan. and Feb.	8 37·5 E.	

$D=-7°{\cdot}40+2{\cdot}92\sin(1{\cdot}35\,m-84°{\cdot}8)$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1825·5	—10·50		— 9·98	+0·52
1836·5	9·75		10·24	—0·49
1874·5	9·50		9·69	—0·19
1878·4	9·37		9·52	—0·15
1890·6	8·89		8·86	+0·03
1891·5	8·81		8·81	0·00
1892·5	8·75		8·74	+0·01
1893·5	8·67		8·68	—0·01
1894·5	8·63		8·62	+0·01
1895·1	— 8·62		— 8·58	+0·04

DIP AND INTENSITY AT SAN ANTONIO.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1878, June 10, 13.	57 34·6	0·2964	0·5528	J. B. Baylor, U. S. Coast S. Arsenal Grounds.
2	1890, Mar. to Dec.	57 35·0	0·2927	0·5459	A. Braid and R. E. Halter, U. S. Coast & G. S. — Magnetic Observatory on Military Reservation.
3	1891, Jan. to Dec.	57 37·1	0·2927	0·5464	R. E. Halter and L. G. Schultz, U. S. Coast & G. S. — Magnetic Observatory on Military Reservation.
4	1892, Jan. to Dec.	57 {40·2, 39·9}	0·2917	0·5454	R. E. Halter and L. G. Schultz, U. S. Coast & G. S. Magnetic Observatory, Military Reservation. After July at Hillside Ranch.
5	1893, Jan. to Dec.	57 41·8	0·2916	0·5456	R. E. Halter and L. G. Schultz, U. S. Coast & G. S. — Magnetic Observatory, Hillside Ranch.
6	1894, Jan. to Dec.	57 44·8	0·2915	0·5462	Do.
7	1895, Jan. and Feb.	57 45·4	0·2914	0·5463	Do.

***Secular variations of the magnetic declination, dip and intensity*—Continued.**

GALVESTON, TEX.

$\varphi = 29° 18'.2$ $\lambda = 94° 47'.5$ W. of Gr.

[Astronomic station.]

No.	Date.	D.	References and remarks.
		° ′	
1	1848, Apr. 24–28.	8 57·4 E.	R. H. Fauntleroy, U. S. Coast S. At Dollar Point in $\varphi = 29° 26'.0$ and $\lambda = 94° 53'.4$. Reduction to Galveston + 3′·3.
2	1868, Feb. 24, 25.	8 42·9 E.	E. Goodfellow, U. S. Coast S. At Dollar Point.
3	1878, May 29, 30, 31.	8 17·3 E.	J. B. Baylor, " " " " " " "
4	1890, Mar. 29, 30.	7 32·8 E.	" " " U. S. Coast & G. S. In $\varphi = 29° 17'.4$, $\lambda = 94° 44'.2$. At Galveston.
5	1895, June 7, 8, 10.	7 19·7 E.	E. Smith, U. S. Coast & G. S. In φ 29° 17′·6, $\lambda = 94° 47'$. At Galveston.

$$D = -8°.33 + 0.0409\,(t - 1876.1) + 0.000732\,(t - 1876.1)^2$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1848·3	—8·90		—8·90	0·00
1868·1	8·66		8·61	+ 0·05
1878·4	8·23		8·23	0·00
1890·2	7·55		7·61	—0·06
1895·4	—7·33		—7·27	+ 0·06

DIP AND INTENSITY AT GALVESTON.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1848, Apr. 25, May 8.	57 53·3	0·3016	0·5671	R. H. Fauntleroy, U. S. Coast S. At Dollar Point.
2	1868, Feb. 24–26.	58 04·1	0·2971	0·5616	E. Goodfellow, U. S. Coast S. At Dollar Point.
3	1878, May 30–June 4.	58 21·5	0·2938	0·5602	J. B. Baylor, " " " " " " "
4	1890, Mar. 29, 30.	57 52·0	0·2901	0·5453	J. B. Baylor, U. S. Coast & G. S. At Galveston.
5	1895, June 7, 8, 10.	58 06·3	0·2885	0·5461	E. Smith, " " " " " "

$$H = 0.3016 - 0.000281\,m$$

Date.	Obs'd H.	Comp'd H.	C—O.
1848·3	0·3016	0·3019	+0·0003
1868·2	·2971	·2965	— 6
1878·4	·2938	·2936	— 2
1890·2	·2901	·2903	+ 2
1895·4	0·2885	0·2888	+0·0003

Secular variations of the magnetic declination, dip and intensity—Continued.

KEY WEST, FLA.

$\varphi = 24° 33'.5$ $\lambda = 81° 48'.5$ W. of Gr.

[Tift's Observatory.]

No.	Date.	D.	References and remarks.
		° ′	
	1700—	5 E.	Sir E. Halley's Tabula Nautica. Not used.
1	1750—	5·6 E.	C. & G. S. Rept. for 1888, p. 308. Deduced from observations at 19 stations.
2	1829, Feb.	6 25 E.	W. A. Whitehead.
3	1843—	6 02 E.	L. M. Powell, U. S. N.
4	1849, Aug. 19–21.	5 29 E.	J. E. Hilgard, U. S. Coast S. At Sand Key.
5	1860, Feb., Mar., June, Dec.	4 46·6 E.	W. P. Trowbridge and S. Walker, U. S. Coast S. At Magnetic Observatory.
6	1861, Feb., Mar., Apr.	4 44·5 E.	S. Walker, J. G. Oltmanns, and F. F. Nes, U. S. Coast Survey. At Magnetic Observatory.
7	1862, May to Dec.	4 39·9 E.	
8	1863, Jan. to Dec.	4 36·8 E.	
9	1864, Jan. to Dec.	4 33·9 E.	
10	1865, Jan. to Dec.	4 31·5 E.	
11	1866, Jan. to Apr., incl.	4 29·8 E.	
12	1879, Mar. 24, 25, 26.	3 34 E.	S. M. Ackley, Lieut. U. S. N. Grounds of Army Hospital.
13	1884, Apr. 4.	3 00 E.	C. Belknap, " " " " Vicinity of Key West, reduction°.
	1884, May 10.	2 49 E.	R. B. Peck, Lieut. U. S. N. Vicinity of Key West, reduction °.
14	1887, Feb. 1, 2, 3.	3 19·8 E.	J. B. Baylor, U. S. Coast & G. S. Grounds of Army Hospital.

$D = -4°.31 + 2.86 \sin (1.30\, m - 23°.9)$*

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1750·0	—5·60		—5·57	+0·03	1863·5	—4·61		—4·62	—0·01
1829·1	6·42		6·54	—0·12	1864·5	4·57		4·56	+0·01
1843·5	6·03		5·84	+0·19	1865·5	4·53		4·50	+0·03
1849·6	5·48		5·49	—0·01	1866·2	4·50		4·45	+0·05
1860·7	4·78		4·81	—0·03	1879·2	3·56		3·62	—0·06
1861·2	4·74		4·77	—0·03	1884·3	2·91		3·30	—0·39
1862·7	—4·67		—4·68	—0·01	1887·1	—3·33		—3·13	+0·20

DIP AND INTENSITY AT KEY WEST.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1849, Aug. 18, 19, 22.	54 25·8	0·3116	0·5357	J. E. Hilgard, U. S. Coast S. At Sand Key. Not used.
2	1860, Feb., Mar., June, Dec.	54 37·8	0·3113	0·5378	W. P. Trowbridge and S. Walker, U. S. Coast S. At Magnetic Observatory.
3	1861, Feb., Mar., Apr.	54 36·8	0·3112	0·5372	S. Walker and J. G. Oltmanns, U. S. Coast S.
4	1862, May to Dec.	54 31·0	0·3109	0·5358	S. Walker, J. G. Oltmanns, and F. F. Nes, U. S. Coast S.
5	1863, Jan. to Dec.	54 31·2	0·3108	0·5354	S. Walker, U. S. Coast S.
6	1864, Jan. to Dec.	54 29·0	0·3107	0·5348	" " " " " "
7	1865, Jan. to Dec.	54 28·8	0·3103	0·5340	" " " " " "
8	1866, Jan. to Apr., incl.	54 28·6	0·3101	0·5334	" " " " " "
9	1879, Mar. 24, 25, May 7.	54 28·6	0·3058	0·5263	Lieut. S. M. Ackley, U. S. N. Grounds of Army Hospital.
10	1887, Feb. 2, 3, 4.	54 26·8	0·3006	0·5170	J. B. Baylor, U. S. Coast & G. S. Grounds of Army Hospital.

* Expression confirmed by an observation in 1896.

Secular variations of the magnetic declination, dip and intensity—Continued.

KEY WEST, FLA.—Continued.

DIP AND INTENSITY AT KEY WEST—Continued.

$$\Theta = 54^\circ{\cdot}60 - 0{\cdot}004\,4\,m$$

Date.	Obs'd Θ.	Comp'd Θ.	C − O.
	°	°	°
1860·5	54·63	54·55	−0·08
1861·2	·61	·55	− ·06
1862·5	·52	·54	+ ·02
1863·5	·52	·54	+ ·02
1864·5	·48	·53	+ ·05
1865·5	·48	·53	+ ·05
1866·2	·48	·52	+ ·04
1879·3	·48	·47	− ·01
1887·1	54·45	54·43	−0·02

HABANA, CUBA.

$\varphi = 23^\circ\ 09'{\cdot}3$ $\lambda = 82^\circ\ 21'{\cdot}5$ W. of Gr.

[Morro light.]

No.	Date.	D.			References and remarks.
		°	′		
	1700—	6		E.	C. & G. S. Rept. for 1888, p. 306; deduced from observations at 17 stations. Not used.
1	1726—	4	24	E.	Mathews. Reduction to Habana + 10′.
2	1732, Mar. and Apr.	4	30	E.	J. Harris.
3	1750—	5½		E.	C. & G. S. Rept. for 1888, p. 308; deduced from observations at 19 stations.
4	1815—	7		E.	Ency. Brit., 7th edition.
5	1816, Aug.	5½		E.	Bentley.
6	1833—	6	50	E.	P. Barlow's isogonic chart.
7	1840—	5	40	E.	Lavallée Becquerel's Trait. de Mag[me]. Cont. to Terr. Mag., Hyd. Office, U. S. N., 1895.
8	1857, Jan. 28.	5	15	E.	K. Friesach.
9	1858—	5	45	E.	A map of Cuba.
10	1874—	4	17	E.	Benito Viñes, S. J. Conts. to Terr. Mag., Hyd. Office, U. S. N., 1895. College de Belen.
11	1879, Mar. 13, 14, 15.	3	54	E.	Lieut. S. M. Ackley, U. S. N. College de Belen.
12	1884, Apr.	2	34	E.	Lieut. C. Belknap, U. S. N.
13	1885, Nov. 5, 6, 14.	3	41·2	E.	B. Viñes. College de Belen.
14	1886, Dec. 21.	3	33·5	E.	" " (−3°·58 when corrected for diurnal variation). College de Belen.
	1887—	3	37	E.	B. Viñes, Conts. to Terr. Mag., Hyd. Office, U. S. N., 1895.
15	1888—	3	37	E.	" " " " " " " " "
16	1889, Jan. 1.	3	33	E.	Lieut. Aubry. Annuaire pour l'an 1891, Paris, 1891. } mean −3°·56.
	1889, Apr.	3	34	E.	B. Viñes. Conts. to Terr. Mag., Hyd. Office, U. S. N., 1895, College de Belen.

$$D = -3^\circ{\cdot}72 + 2{\cdot}79 \sin(1{\cdot}05\,m - 36^\circ{\cdot}7)$$

Date.	Obs'd D.	p.	Comp'd D.	C − O.	Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°		°		°	°
1726·5	−4·57		−4·38	+0·19	1858·5	−5·75		−5·02	+0·73
1732·3	4·50		4·66	−0·16	1874·5	4·28		4·25	+0·03
1750·0	5·50		5·45	+0·05	1879·2	3·90		4·01	−0·11
1815·5	7·00		6·39	+0·61	1884·3	2·73	½	3·75	−1·02
1816·6	5·50		6·37	−0·87	1885·9	3·65		3·67	−0·02
1833·0	5·83		5·99	−0·16	1887·2	3·59		3·60	−0·01
1840·5	5·67		5·75	−0·08	1888·5	3·62		3·54	+0·08
1857·1	−5·25		−5·08	+0·17	1889·2	−3·56		−3·50	+0·06

Secular variations of the magnetic declination, dip and intensity—Continued.

HABANA, CUBA—Continued.

DIP AND INTENSITY AT HABANA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1801, Jan.	53 22	......	......	A. von Humboldt.
2	1822—	51 55	0·3214(?)	0·5210(?)	Sir E. Sabine.
3	1857, Jan. 27, 28.	52 00	0·3191	0·5184	K. Friesach.
4	1879, Mar. 13–16.	52 18·1	0·3157	0·5164	Lieut. S. M. Ackley, U. S. N. At College de Belen.
5	1885 { Nov. 10, 12. Dec. 29, 30.	52 19·6	0·3119	0·5104	Benito Viñes, S. J. At College de Belen.
6	1886, Dec. 29, 30.	52 13·3	0·3123	0·5098	" " " " " " " "
7	1889, Jan.	52 10	......	......	Lieut. Aubry. Annuaire pour l'an 1891; Paris, 1891.

KINGSTON, JAMAICA.

$\varphi = 17° 55'·9$ $\lambda = 76° 50'·6$ W. of Gr.

[Port Royal flagstaff.]

No.	Date.	D.	References and remarks.
		° ′	
	1660—	6½ E.	According to J. Robertson. Not used.
	1700—	6½ E.	Mountain's Chart. Not used.
	1700—	7 E.	Sir E. Halley's Tabula Nautica. Not used.
1	1726, Sept. 12.	4 31 E.	Mathews. At Port Royal.
2	1732, Mar. and Apr.	6 02 E.	J. Harris. At Black River.
3	1789 to 1793.	6 50 E.	J. Leard.
	1791 to 1792.	6 45 E.	J. Leard.
4	1806—	6 30 E.	J. Robertson.
5	1819—	4 50 E.	De Mackau.
	1821—	4 50 E.	De Mayne.
6	1822—	4 54 E.	Owen.
7	1832—	5 13 E.	Foster.
8	1833(?)—	4 40 E.	Map of Kingston.
	1833—	6½ E.	P. Barlow's isogonic chart. Not used.
9	1837, Oct.	4 18 E.	Milne.
10	1847, Apr.	3 40 E.	Capt. E. Barnett, R. E.
11	1857, Mar. 2	3 40 E.	K. Friesach.
	1866—	4 57 E.	Brit. Admiralty Chart No. 446. Not used.
12	1875—	4 00 E.	Brit. Admiralty Chart No. 456.
13	1876—	3 35 E.	Brit. Admiralty Chart No. 762.
14	1880—	3 06 E.	Chart of curves of equal magnetic variation, Brit. Adm'y, 1880.
15	1884, Feb. 8.	2 20 E.	Lieut. R. B. Peck, U. S. N.

$$D = -3°·81 + 2·39 \sin (1·10\, m - 10°·6)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1726·7	—4·52		—5·14	—0·62	1837·8	—4·30		—4·78	—0·48
1732·2	6·04		5·34	+0·70	1847·3	3·67		4·37	—0·70
1791·8	6·78		6·11	+0·67	1857·2	3·67		3·92	—0·25
1806·5	6·50		5·85	+0·65	1875·5	4·00		3·10	+0·90
1820·0	4·83		5·46	—0·63	1876·5	3·58		3·05	+0·53
1822·5	4·90		5·37	—0·47	1880·5	3·10		2·88	+0·22
1832·5	5·22		5·00	+0·22	1884·1	—2·33		—2·73	—0·40
1833·5	—4·67		—4·96	—0·29					

Secular variations of the magnetic declination, dip and intensity—Continued.

KINGSTON, JAMAICA—Continued.

DIP AND INTENSITY AT KINGSTON.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1822—	46 55	......	......	Sir E. Sabine.
2	1834—	47 19	......	......	Capt. E. Barnett, R. E.
	1834, July 11, Aug. 1, Sept. 30, Oct. 6.	47 01·3	0·3307	0·4851	Sir E. Home.
3	1857, Feb. 25, Mar. 2.	46 32	0·3310	0·4812	K. Friesach.

BRIDGETOWN, BARBADOS.

$\varphi = 13° 05'.7$ $\lambda = 59° 37'.3$ W. of Gr.

[Rickett's Battery.]

No.	Date.	D.	References and remarks.
		° ′	
1	1700.	5⅓ E.	Sir E. Halley's Tabula Nautica.
2	1726, June 26, 28, Oct. 23.	4 24 E.	Mathews.
	1726, June 29.	3 29 E.	C. Hansteen's "Mag. der Erde." At Lambert Point.
3	1760, May 28, 31.	4 30 E.	Ross.
4	1761, May.	3 47 E.	
5	1833—	1 29 E.	Phillips.
6	1839—	1 13 E.	Milne.
7	1846—	1 27 E.	Sir R. H. Schomburgk.
8	1871—	0 35 E.	Staff Com. Parsons.
	1884, Apr. 24.	1 50 W.	Lieut. Hanford, U. S. N., reduction to Bridgetown —15′. Not used.
9	1890, May 2, 4, 8, 9.	1 12 W.	E. D. Preston, U. S. Coast & G. S. At Hastings, near the old naval hospital and the Transit of Venus station of 1882. Value reduced to mean of day.

$D = -1°.88 + 2.83 \sin (0.95\, m + 24°.6)$. Expressions very doubtful.

Date.	Ob'sd D.	*p*.	Comp'd D.	C — O.
	°		°	°
1700·0	—5·33		—4·38	+0·95
1726·5	3·92		4·71	—0·79
1760·4	4·50		4·34	+0·16
1761·3	3·78		4·32	—0·54
1833·5	1·48		1·44	+0·04
1839·5	1·22		1·17	+0·05
1846·5	1·45		—0·85	+0·60
1871·5	—0·58		+0·12	+0·70
1890·3	+1·20	2	+0·64	—0·56

DIP AND INTENSITY AT BRIDGETOWN.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1722¾.	44½	......	......	Capt. Othniel Beal. Recovered by Dr. L. A. Bauer. "Nature," No. 1317.
2	1835, May 11.	43 45·9	0·3066	0·4233	Sir E. Home.
3	1836, Jan. 5.	43 28·8			" " "
4	1846—	43 57	......	......	Sir R. H. Schomburgk.

Secular variations of the magnetic declination, dip and intensity—Continued.

PANAMA, NEW GRANADA.

$\varphi = 8° 57'.1$ $\lambda = 79° 32'.2$ W. of Gr.

[Cathedral.]

No.	Date.	D.	References and remarks.
		° ′	
	1700—	10 E.	C. & G. S. Rept. for 1888, p. 306, deduced from observations at 17 stations. Not used.
1	1775, Nov.	7 49 E.	Encycl. Brit., 7th edition.
2	1790, Oct. 3.	7 49 E.	Don A. Malaspina.
	1791, Dec.	7 49 E.	Encycl. Brit., 7th edition; probably the same as above. Not used.
3	1802—	8 E.	Encycl. Brit., 7th edition.
4	1822—	7 E.	Hall.
5	1837—	7 02 E.	Sir E. Belcher.
6	{ 1849—	7 15 E.	Hughes.
	{ 1849—	6 55 E.	Maj. W. H. Emory.
7	1858—	6 17 E.	K. Friesach.
8	1866, May 14.	5 56 E.	Prof. W. Harkness, U. S. N.
9	1873, Dec. 25.	6 57 E.	Logbooks of the Benicia and Richmond, U. S. N.; off Point Mala. Reduction to Panama —38′.
10	1880—	5 24 E.	Chart of curves of equal magnetic variation. Brit. Adm.
11	1883, Feb. 22.	5 02 E.	Annales du Bureau des Longitudes, Paris, 1883.
12	1884, Mar. 20.	5 23 E.	Lieut. C. Belknap, U. S. N. Reduction to Panama inappreciable.

$$D = -5°.66 + 2.22 \sin (1.10\, m - 27°.8)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1775.8	—7.82		—7.71	+0.11	1858.5	—6.28		—6.34	—0.06
1790.8	7.82		7.83	—0.01	1866.4	5.93		6.02	—0.09
1802.5	8.00		7.79	+0.21	1873.9	6.32	½	5.71	+0.61
1822.5	7.00	½	7.49	—0.49	1880.5	5.40		5.44	—0.04
1837.5	7.03		7.09	—0.06	1883.1	5.03		5.33	—0.30
1849.5	—7.08		—6.69	+0.39	1884.2	—5.38		—5.29	+0.09

DIP AND INTENSITY AT PANAMA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1790, Oct. 3.	29 29	......	......	Don A. Malaspina.
2	1837—	31 51.9	0.3570	0.4204	Sir E. Belcher.
3	1858, Apr. 29, May 2.	32 30	0.3529	0.4184	Capt. R. W. Haig.
4	1866, May 14.	31 56	0.3511	0.4137	Prof. W. Harkness, U. S. N.

GROUP III.

Secular variations of the magnetic declination, dip and intensity.

[Western stations.]

CHAMISSO ISLAND, KOTZEBUE SOUND, ALASKA.

$\varphi = 66° 13'$ $\lambda = 161° 49'$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1728—	32 33 E.	Deduced from a discussion of 21 observations made by V. J. Bering off the coast of Kamchatka between 1725 and 1730; see C. & G. S. Rept. for 1891, Appendix No. 5.
2	{ 1826, Aug.	31 24 E.	Capt. F. W. Beechey (Narrative).
	{ 1826—	31 10 E.	Brit. Adm. Chart 593.
	1826—	28 53 E.	Capt. F. W. Beechey (Sabine's Contrib's). Not used.
3	1849—	30 26 E.	Capt. H. Kellett.
4	1880, Aug. 31.	26 49 E.	W. H. Dall and M. Baker, U. S. Coast & G. S. Chamisso Harbor.

Secular variations of the magnetic declination, dip and intensity—**Continued.**

CHAMISSO ISLAND, KOTZEBUE SOUND, ALASKA—Continued.

$D = -29°.88 + 4.35 \sin (1.2\, m + 2°.6)$. Expression uncertain.

Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°
1728·5	−32·55		−32·49	+0·06
1826·5	31·29		31·76	−0·47
1849·5	30·43		29·73	+0·70
1880·7	−26·82		−27·12	−0·30

DIP AND INTENSITY AT CHAMISSO ISLAND.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1827—	77 39	......	......	Capt. F. W. Beechey.
2	1880, Aug. 31.	77 17·4	0·1287	0·5849	W. H. Dall and M. Baker, U. S. Coast & G. S. Chamisso Harbor.

PORT CLARENCE, ALASKA.

$\varphi = 65° 16'$ $\lambda = 166° 50'$ W. of Gr.

[Point Spencer.]

No.	Date.	D.	References and remarks.
		° ′	
1	1728—	29·1 E.	Deduced from a discussion of 21 observations made by V. J. Bering off the coast of Kamchatka between 1725 and 1730; see C. & G. S. Rept. for 1891, Appendix No. 5.
2	1827—	26 55 E.	Capt. F. W. Beechey. At Port Clarence and Grantey Bay.
3	1850—	26 26 E.	Capt. H. Kellett.
4	1854—	26 00 E.	Capt. Maguire.
5	1879, July.	23 01 E.	A. Wÿkander.
6	1880, Sept. 8.	22 45 E.	W. H. Dall and M. Baker, U. S. Coast & G. S. Near Point Spencer.

$D = -26°.09 + 4.41 \sin (1.2\, m + 4°.6)$. Expression uncertain.

Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°
1728·5	−29·10	½	−28·86	+0·24
1827·5	26·91	.	27·77	−0·86
1850·5	26·43		25·69	+0·74
1854·5	26·00		25·32	+0·68
1879·5	23·02		23·25	−0·23
1880·7	−22·75		−23·17	−0·42

DIP AND INTENSITY AT PORT CLARENCE.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1850—	75 48	......	......	Capt. R. Collinson.
2	1854—	76 30	......	......	Capt. Maguire.
3	1879, July.	76 05	0·1396	0·5804	A. Wÿkander.
4	1880, Sept. 6, 8.	76 04·0	0·1393	0·5785	W. H. Dall and M. Baker, U. S. Coast & G. S. Near Point Spencer.

Secular variations of the magnetic declination, dip and intensity—Continued.

PORT ETCHES, CONSTANTINE HARBOR, ALASKA.

$\varphi = 60° 20'·7$ $\lambda = 146° 37'·6$ W. of Gr.

[Astronomic station of 1874.]

No.	Date.	D.	References and remarks.
		° ′	
1	1778, May 19.	23 37 E.	Capt. J. Cook.
2	{ 1787, May.	26 E.	Portlock; at Chalmers Harbor, $\varphi = 60° 17'$, $\lambda = 147° 27'$.
	{ 1787, May and July.	26½ E.	" " Garden Cove, $\varphi = 60° 20'·5$, $\lambda = 146° 46'$.
	1787—	27 E.	J. Johnstone; at Cape Hinchinbrook, $\varphi = 60° 18'$, $\lambda = 147° 01'$. Not used.
3	1788, May 17.	25 E.	Don E. Martinez; in $\varphi = 60° 10'$, $\lambda = 147° 35'$.
4	{ 1790—	26 28 E.	Sarycheff; at Nuchek, in $\varphi = 60° 18'$, $\lambda = 146° 32'$.
	{ 1790, May 23.	26 E.	Fidalgo, in $\varphi = 60° 12'$, $\lambda = 146° 31'$.
	1790, July 30.	28½ E.	J. Billings. Not used.
5	1794, June.	28 30 E.	Capt. G. Vancouver; at Port Chalmers, $\varphi = 60° 16'$, $\lambda = 146° 38'$.
6	1810 (?).	28 08 E.	Sarycheff; at Nuchek, $\varphi = 60° 17'$, $\lambda = 147° 00'$.
7	1830—	31 38 E.	Chernoff; " " $\varphi = 60° 20'$, $\lambda = 146° 32'·5$.
8	1837, Aug. 27.	31 38 E.	Sir E. Belcher; near Phipps Point, $\varphi = 60° 21'$, $\lambda = 146° 41'$.
9	1874, May 31.	29 10 E.	M. Baker, U. S. Coast S. Near Phipps Point.
10	1894, June 18.	27 24 E.	Lieut. J. B. Collins, U. S. S. Mohican. Notice to Mariners of Nov. 10, 1894. At Phipps Point.

$D = -22°·40 + 9·13 \sin(1·2\,m - 83°·6)$. Expression very uncertain.

Date.	Obs'd D.	p.	Comp'd D.	C−O.
	°		°	°
1778·4	−23·62	½	−24·06	−0·44
1787·4	26·25		25·71	+0·54
1788·4	25·00		25·90	−0·90
1790·5	26·23		26·26	−0·03
1794·5	28·50		26·94	+1·56
1810·5	28·13		29·29	−1·16
1830·5	31·63		31·13	+0·50
1837·7	31·63		31·43	+0.20
1874·4	29·17		29·81	−0·64
1894·5	−27·40	¼	−26·99	+0·41

DIP AND INTENSITY AT PORT ETCHES.

No.	Date.	Θ.	H.	F.	Reference.
		° ′			
1	1837—	76 02·9	0·1452	0·6022	Sir E. Belcher. Near Phipps Point.

***Secular variations of the magnetic declination, dip and intensity*—Continued.**

PORT MULGRAVE, YAKUTAT BAY, ALASKA.

$\varphi = 59° 33'.8$ $\lambda = 139° 47'.3$ W. of Gr.

[Astronomic station, Khantaak Island.]

No.	Date.	D.	References and remarks.
		° ′	
1	1778, May 6.	23 10 E.	Capt. J. Cook. At sea in $\varphi = 59° 08'$, $\lambda = 139° 41'$.
	1778, May 7.	24 26 E.	" " " " south of Mount St. Elias, $\varphi = 59° 27'.5$, $\lambda = 140° 53'$.
2	1787, May.	26 E.	Capt. G. Dixon, Port Mulgrave.
3	1791, July 1.	26 40 E.	Don A. Malaspina, on shore, Bahia de Monti, in $\varphi = 59° 33'.7$, $\lambda = 139° 46'.3$.
4	1794, July.	26 E.	Capt. G. Vancouver, at Port Mulgrave.
5	1802, about.	29 E.	Russian chart. $\varphi = 59° 31'$, $\lambda = 139° 36'.5$.
6	1823—	30 30 E.	Khromchenko, at end of spit, in $\varphi = 59° 33'.6$, λ 139° 46′.5.
7	1874, May 22.	29 58 E.	M. Baker, U. S. Coast S. At Port Mulgrave.
8	1880, June 24.	30 00 E.	" " " " & G. S. At Port Mulgrave.
	1891—	27 19 E.	I. C. Russell, Yakutat Bay. Second expedition to the Mount St. Elias Alps. Not used.
9	1892, Sept. 2, 3, 4.	29 55.8 E.	J. H. Turner, U. S. Coast & G. S. On Khantaak Island.
	1892, July, Aug., Sept.	30 43 E.	J. E. McGrath, U. S. Coast & G. S. At both ends of Malaspina Base, at Mount Hoorts, and at Ocean Cape, mean ¼ (30° 54′, 30° 42′, 30° 51′, 30° 24′) = 30° 43′. Not used.
10	1894, June.	30 43 E.	J. E. McGrath, U. S. Coast & G. S. At west end of Malaspina Base and several places west of it. Mean value. Reduction to Khantaak Island — 47′.

$D = -24°.02 + 7.48 \sin (1.1\, m - 95°.0)$. A rough and doubtful representation.

Date.	Obs'd D.	p.	Comp'd D.	C — O.
	°		°	°
1778.3	−23.80	½	−24.81	−1.01
1787.4	26.00		26.09	−0.09
1791.5	26.67		26.65	+0.02
1794.5	26.00	¼	27.06	−1.06
1802.0	29.00		27.99	+1.01
1823.5	30.50		30.21	+0.29
1874.4	29.97		30.96	−0.99
1880.5	30.00		30.59	−0.59
1892.7	29.93	2	29.58	+0.35
1894.4	−29.93		−29.42	+0.51

DIP AND INTENSITY AT PORT MULGRAVE, YAKUTAT BAY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1791, July 1.	76 46.8	......	......	Don A. Malaspina.
2	1880, June 24.	76 17.9	0.1414	0.5970	W. H. Dall and M. Baker, U. S. Coast & G. S. Port Mulgrave.
3	1892, Sept. 2–4.	76 11.5	0.1422	0.5958	J. H. Turner, U. S. Coast & G. S. Khantaak Island.

Secular variations of the magnetic declination, dip and intensity—Continued.

ST. PAUL, KADIAK ISLAND, ALASKA.

$\varphi = 57° 48'.0$ $\lambda = 152° 21'.3$ W. of Gr.

[Astronomic station of 1867.]

No.	Date.	D.	References and results.
		° ′	
1	{ 1778, May 21. { 1778, June 13.	23 42 E. 20 31 E.	Capt. J. Cook; at sea off Pye Island, in $\varphi = 59° 30'$, $\lambda = 149° 54'$. " " " " " " SW. end Kadiak Island, in $\varphi = 56° 49'$, $\lambda = 154° 20'$. The mean position is $\varphi = 58° 10'$, $\lambda = 152° 07'$, and the mean declination giving the first value double weight — 22°.60.
	1779, Aug. 9.	27 E.	San Virey and Ant. Bucareli; at sea in $\varphi = 57° 59'$, $\lambda = 152° 07'$. Not used.
2	1790—	25½ E.	Sarycheff, chart.
	1790, July 10.	22 10 E.	Fidalgo, in $\varphi = 58° 10'$, $\lambda = 152° 07'$. Not used.
3	1804, Aug. 16.	26 07 E.	U. Lisiansky.
4	{ 1808— { 1808—	26 E. 25½ E.	} Russian naval officer.
5	1818, July 19.	26½ E.	V. M. Golovnin, in front of Governor's House, in $\varphi = 57° 47'.2$, $\lambda = 152° 18'.3$.
6	1834—	28 38 E.	Murasheff, St. Paul Harbor.
7	1839, July.	26 43 E.	Sir E. Belcher, near Cape Greville in $\varphi = 57° 20'$, $\lambda = 152° 51'$.
8	1845 (?).	27 E.	Vasilieff, St. Paul Harbor.
9	1867, Aug. 28, 29.	26 05 E.	A. T. Mosman, U. S. Coast S., at astronomic station on bluff east of village.
10	1874, June 7.	25 22 E.	M. Baker, U. S. Coast S.
11	1880, July 9.	25 09 E.	" " & G. S., at Chagafka Cove.

$D = -22°.21 + 5.18 \sin (1.35\,m - 72°.5)$. Expression very uncertain.

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1778.4	—22.60	½	—23.18	—0.58	1839.5	—26.72		—27.38	—0.66
1790.5	25.50		24.58	+0.92	1845.5	27.00		27.29	—0.29
1804.6	26.12		25.95	+0.17	1867.7	26.08		26.09	—0.01
1808.5	25.75		26.27	—0.52	1874.4	25.37		25.51	—0.14
1818.5	26.50		26.90	—0.40	1880.5	—25.15		—24.90	+0.25
1834.5	—28.63		—27.38	+1.25					

DIP AND INTENSITY AT ST. PAUL, KADIAK ISLAND.

No.	Date.	Θ.	H.	F.	Reference.
		° ′			
1	1880, July 12.	72 34.6	0.1716	0.5730	W. H. Dall and M. Baker, U. S. Coast & G. S.

SITKA, ALASKA.

$\varphi = 57° 02'.9$ $\lambda = 135° 20'.4$ W. of Gr.

[Astronomic station.]

No.	Date.	D.	References and remarks.
		° ′	
	1775, Aug. 23.	22 E.	Don Bruno de Heceta. Not used.
1	1779, July 7.	23½ E.	San Virey and Ant. Bucareli.
2	1786, Aug. 6, 7.	26 46 E.	La Perouse.
3	1787, June.	24 E.	Capt. G. Dixon.
4	1791, Aug. 8, 11, 21.	27 46 E.	Capt. E. Marchand.
5	1804, Aug. 20.	26 45 E.	Capt. U. Lisiansky.
6	1818, July.	27 15 E.	Capt. V. M. Golovnin.
7	1824, Aug.	27 30 E.	Von Kotzebue.
8	1827—	28 50 E.	Capt. F. P. Lütke.
9	1829, Nov. 10.	28 19 E.	A. Erman.

Secular variations of the magnetic declination, dip and intensity—Continued.

SITKA, ALASKA—Continued.

No.	Date.	D.	References and remarks.
		° ′	
10	1837, Sept. 12-16.	27 24 E.	Sir E. Belcher.
	1839, July 15-19.	29 32 E.	
11	1842, all months but Jan., Feb., and Oct.	28 32.4 E.	Magnetic observatory on Japonski Island.*
12	1843, whole year.	28 54.0 E.	
13	1844, " "	28 57.3 E.	
14	1845, " "	29 00.0 E.	
15	1847, May to Dec.	28 58.9 E.	
16	1848, whole year.	29 04.5 E.	
17	1849, Jan., Feb., Mar.	29 03.6 E.	
18	1850, whole year.	28 50.3 E.	
	1851—	29 14 E.	Capt. R. Collinson.
19	1851, whole year.	28 53.1 E.	Magnetic observatory on Japonski Island.*
20	1852, Jan. to July, Nov. and Dec.	28 48.5 E.	
21	1856—	28 58.6 E.	
22	1857, whole year.	29 07.2 E.	
23	1858, " "	29 10.5 E.	
24	1859, " "	29 06.1 E.	
25	1860, " "	29 07.9 E.	
26	1861—	29 04.1 E.	
27	1862, whole year.	29 00.9 E.	
28	1863—	29 03.3 E.	
29	1864—	29 04.2 E.	
30	1867, Aug. 17, 18, 19, 20.	28 49 E.	A. T. Mosman, U. S. Coast S.
31	1874, May 4, 5.	28 59.5 E.	M. Baker, " " "
32	1876, Jan. 15 to Mar. 20.	28 20.5 E.	Capt. J. B. Campbell and Lieut. W. R. Quinan.
33	1879, Apr.	28 54 E.	Lieut. J. E. Craig.
34	1880, May 17, 18.	29 05 E.	M. Baker and W. H. Dall, U. S. Coast & G. S.
35	1880, Sept. 15, 16.	29 11 E.	H. E. Nichols, U. S. N.
36	1892, May 19, 20, 21.	29 32.9 E.	F. Morse, U. S. Coast & G. S. On Parade Ground, Sitka.
	1892, June 14, 15.	29 26.8 E.	" " " Japonski Island, Sitka Harbor.
	1892, Sept. 7, 8.	29 35.0 E.	J. E. McGrath, U. S. Coast & G. S. On Parade Ground.
37	1893, Aug. 15, 16, 17.	29 33.8 E.	F. Morse, " " " "
38	1894, May 22, 23, 24.	29 36.9 E.	" " " " "

* The observations at Japonski Island are supposed to have been made under the direction of Syrianow. Annales du bureau des longitudes, Vol. IV, Paris, 1890. With respect to the differential observations see note on p. 287 of C. & G. S. Report for 1888. A second periodic term (of short period) requires to be introduced and consequently the present term is to be modified as soon as the progress of the phenomenon can be better understood.

$D = -25^\circ.48 + 3.84 \sin (1.00\, m - 116^\circ.1) + 0.32 \sin (6.5\, m + 321^\circ)$. An approximate expression. [N. B. The last term applied only since 1830.]

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1779.5	—23.50		—25.04	—1.54	1852.4	—28.81		—29.12	—0.31
1786.5	26.77		25.50	+1.27	1856.5	28.98		29.08	—0.10
1787.4	24.00		25.56	—1.56	1857.5	29.12		29.07	+0.05
1791.6	27.77		25.85	+1.92	1858.5	29.18		29.05	+0.13
1804.6	27.75		26.70	+1.05	1859.5	29.10		29.04	+0.06
1818.5	27.25		27.53	—0.28	1860.5	29.13		29.02	+0.11
1824.5	27.50		27.86	—0.36	1861.5	29.07		29.00	+0.07
1827.5	28.83		28.02	+0.81	1862.5	29.02		29.00	+0.02
1829.9	28.31		28.20	+0.11	1863.5	29.06		29.00	+0.06
1838.6	28.62		28.81	+0.19	1864.5	29.07		28.98	+0.09
1842.6	28.54		28.99	—0.45	1867.6	28.82		28.97	—0.15
1843.5	28.90		29.02	—0.12	1874.3	28.99		29.04	—0.05
1844.5	28.96		29.05	—0.09	1876.1	28.34		29.08	—0.74
1845.5	29.00		29.08	—0.08	1879.3	28.90		29.16	—0.26
1847.7	28.98		29.12	—0.14	1880.4	29.08		29.20	—0.12
1848.5	29.08		29.12	—0.04	1881.7	29.19		29.23	—0.04
1849.1	29.06		29.12	—0.06	1892.5	29.53		29.43	+0.10
1850.5	28.84		29.13	—0.29	1893.6	29.56		29.43	+0.13
1851.5	—28.88		—29.12	—0.24	1894.4	—29.62		—29.43	+0.19

Secular variations of the magnetic declination, dip and intensity—Continued.

SITKA, ALASKA—Continued.

DIP AND INTENSITY AT SITKA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1786, Aug. 6, 7.	73 30(?)	......	......	La Perouse.
2	1818, July.	76 33	......	......	Capt. V. M. Golovnin.
3	1827—	75 55	......	0·6059(?)	Capt. F. P. Lütke.
4	1829·9	75 50·6	......	0·6026(?)	A. Erman.
5	1837—	75 51·5	......	......	Sir E. Belcher.
6	1839—	75 49·1	0·1479	0·6038	"
7	1842—	75 51	......	......	Magnetic observatory on Japonski Island.
8	1845, Jan.-Dec.	75 54·6	......	......	" " " "
9	1851—	76 20(?)	......	......	Capt. R. Collinson.
10	1880, May 17, 18.	75 11·7	0·1526	0·5972	W. H. Dall and M. Baker, U. S. Coast & G. S.
11	1881, Sept. 12-16.	75 16·6	0·1518	0·5976	H. E. Nichols, U. S. N. At Japonski Island.
12	1892, May 19, 20, 21.	75 04·6	0·1530	0·5942	F. Morse, U. S. Coast & G. S. On Parade Ground.
12	1892, June 14, 15.	75 02·0	0·1531	0·5926	F. Morse, U. S. Coast & G. S. On Japonski Island.
12	1892, Sept. 7, 8.	75 09·4	0·1527	0·5961	J. E. McGrath, U. S. Coast & G. S. On Parade Ground.
12	1892, Sept. 12, 13.	75 05·6	0·1527	0·5936	J. E. McGrath, U. S. Coast & G. S. On Japonski Island.
13	1893, Aug. 15, 16, 17.	75 01·7	0·1532	0·5930	F. Morse, U. S. Coast & G. S. On Parade Ground.
14	1894, May 22, 23, 24.	75 00·5	0·1535	0·5934	F. Morse, U. S. Coast & G. S. On Parade Ground.

$$\Theta = 75^\circ{\cdot}672 - 0{\cdot}017\,5\,m + 0{\cdot}000\,064\,2\,m^2$$
$$H = 0{\cdot}149\,0 + 0{\cdot}000\,098\,m$$
$$F = 0{\cdot}602\,90 - 0{\cdot}000\,114\,m - 0{\cdot}000\,002\,28\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.	Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°		°	°	°
1818·5	76·55	76·29	—0·26	1845·5	75·91	75·75	—0·16
1827·5	75·92	76·10	+0·18	1880·4	75·20	75·20	0·00
1829·9	75·84	76·05	+0·21	1881·7	75·28	75·18	—0·10
1837·5	75·86	75·90	+0·04	1892·6	75·06	75·04	—0·02
1839·5	75·82	75·86	+0·04	1893·6	74·98	75·03	+0·05
1842·5	75·85	75·80	—0·05	1894·4	74·96	75·02	+0·06

Date.	Obs'd H.	Comp'd H.	C—O.
1839·5	0·1479	0·1480	+0·0001
1880·4	0·1526	0·1520	— 6
1881·7	0·1518	0·1521	+ 3
1892·6	0·1529	0·1532	+ 3
1893·6	0·1532	0·1533	+ 1
1894·4	0·1535	0·1534	—0·0001

Date.	Obs'd F.	Comp'd F.	C—O.
1827·5	0·6059	0·6043	—0·0016
1829·9	0·6026	0·6043	+0·0017
1839·5	0·6038	0·6039	+0·0001
1880·4	0·5971	0·5973	+0·0002
1881·7	0·5976	0·5970	—0·0006
1892·6	0·5941	0·5939	—0·0002
1893·6	0·5930	0·5936	+0·0006
1894·4	0·5934	0·5933	—0·0001

Secular variations of the magnetic declination, dip and intensity—Continued.

SITKA, ALASKA—Continued.

COMPUTED DECENNIAL VALUES.

[H by means of Θ and the above values for F.]

Date.	D.	Θ.	H.	F.
	°	°		
1810	—27·0	76·48	......	......
1820	27·6	76·26	0·1435	0·6043
1830	28·0	76·05	·1457	·6043
1840	28·5	75·85	·1476	·6038
1850	29·1	75·67	·1492	·6029
1860	29·0	75·50	·1505	·6015
1870	29·1	75·35	·1516	·5997
1880	29·2	75·21	·1525	·5974
1890	29·4	75·08	·1531	·5947
1900	—29·4	74·96	0·1535	0·5915

(See diagram of secular variation of a freely suspended needle, Pl. C.)

ILIULIUK, UNALASKA ISLAND, ALASKA.

$\varphi = 53° \ 52'\!\cdot\!6$ $\lambda = 166° \ 31'\!\cdot\!5$ W. of Gr.

[Greek Church.]

No.	Date.	D.	References and remarks.
		° ′	
	1778, Oct. 12.	19 59 E.	Capt. J. Cook, on shore of Samganuda Harbor. Not used.
	1789—	19½ E.	J. H. Cox, at Muscle Cove. Not used.
1	1790, June 4–13.	19 35 E.	J. Billings, on Beavor Bay.
2	1792—	19 E.	Sarycheff, at Iliuliuk.
3	1817, June.	19 24 E.	Von Kotzebue, at Iliuliuk.
4	1827, Aug. 11.	19 50 E.	Capt. F. P. Lütke.
	1829	19 54 E.	Capt. F. P. Lütke. Not used.
5	1831–	19 30 E.	Vasilieff (?), at sea north of Akutan.
	1848–	19 30 E.	Russian chart. Not used.
6	1849–	20 00 E.	Tebenkoff's Atlas.
7	1867, Sept. 8, 9.	19 47 E.	A. T. Mosman, U. S. Coast S. In Captains Harbor.
8	1870–	19 45 E.	Kadin.
	1871, Nov. 11.	18 36 E.	W. H. Dall, U. S. Coast S. On Amaknak Island. Not used.
9	1873, May 26, 27.	19 07 E.	" " At Iliuliuk.
	1873, Sept. 17, 18, 19.	19 00 E.	M. Baker, " On Amaknak Island.
10	1874, Sept. 15.	18 43 E.	" "
11	1880, July 28, 29.	18 38 E.	" and W. H. Dall, U. S. Coast & G. S.
12	1883, Sept. 20, 21.	18 43 E.	R. A. Marr, U. S. Coast & G. S. Captains Harbor.
13	1889, June 28, 29.	17 46·0 E.	J. E. McGrath, " " Amaknak Island, near station of 1880.
	1889, July 28, 29.	18 12·4 E.	J. H. Turner, U. S. Coast & G. S. Amaknak Island, near station of 1880.
14	1891, July 15, 16, 17.	18 06·9 E.	J. H. Turner, U. S. Coast & G. S. Amaknak Island, near station of 1880.
15	1893, Aug. 30.	18 39 E.	N. Ludlow, Comd'r U. S. N. "Hydrographic Information."

$$D = -17°\!\cdot\!65 + 2\cdot26 \sin(1\cdot3\, m - 69°\!\cdot\!0)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1790·4	—19·58		—18·90	+0·68	1873·5	—19·06		—19·05	+0·01
1792·5	19·00		18·99	+0·01	1874·7	18·71		19·01	—0·30
1817·5	19·40		19·76	—0·36	1880·6	18·63		18·75	—0·12
1827·6	19·83		19·91	—0·08	1883·7	18·71		18·61	+0·01
1831·5	19·50		19·91	—0·41	1889·5	17·99		18·33	—0·34
1849·5	20·00		19·77	+0·23	1891·5	18·11		18·24	—0·31
1867·7	19·79		19·27	+0·52	1893·7	—18·65		18·13	+0·52
1870·5	—19·75		—19·17	+0·58					

Secular variations of the magnetic declination, dip and intensity—Continued.

ILIULIUK, UNALASKA ISLAND, ALASKA—Continued.

DIP AND INTENSITY AT ILIULIUK, UNALASKA ISLAND.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1778, Oct, 12.	69 23·5	......	......	Capt. J. Cook
2	1817, June.	68 45	......	......	O. von Kotzebue.
3	1827, Aug. 11.	68 25·6	......	0·5602(?)	F. P. Lütke.
4	1829—	68 26	......	0·5750(?)	" " "
5	1849—	68 22	......	......	Tebenkoff. At Iliuliuk.
6	1880, July and Oct.	67 35·8	0·2055	0·5391	W. H. Dall and M. Baker, U. S. Coast & G. S.
7	1883, Sept, 19, 20, 21.	....	0·2022	......	R. A. Marr, U. S. Coast & G. S.
8	1889, June 28, 29.	67 06·8	0·2052	0·5277	J. H. Turner, U. S. Coast & G. S. On Amaknak Island.
9	1891, July 15, 16, 17.	67 17·2	0·2057	0·5328	J. H. Turner and H. W. Edmonds, U. S. Coast & G. S. On Amaknak Island.

$$\Theta = 68°\cdot13 - 0\cdot017\ 9\ m - 0\cdot000\ 022\ 7\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1778·8	69·39	69·29	—0·10
1817·4	68·75	68·69	—0·06
1827·6	68·43	68·52	+0·09
1829·5	68·43	68·49	+0·06
1849·5	68·37	68·14	—0·23
1880·6	67·60	67·56	—0·04
1889·5	67·11	67·39	+0·28
1891·5	67·29	67·35	+0·06

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1770	—18·0	69·42
1780	18·4	69·27
1790	18·9	69·12
1800	19·3	68·97
1810	19·6	68·81
1820	19·8	68·65
1830	19·9	68·48
1840	19·9	68·31
1850	19·8	68·13
1860	19·5	67·95
1870	19·2	67·76
1880	18·8	67·57
1890	18·3	67·38
1900	—17·8	67·18

(See diagram of secular variation of a freely suspended needle, Pl. C.)

PETROPAVLOVSK, KAMCHATKA.

$\varphi = 53°\ 01'$ $\lambda = 158°\ 43'$ E. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1728—	10·1 E.	Deduced from a discussion of 21 observations made by V. J. Bering off the coast of Kamchatka between the years 1725 and 1730; see C. & G. S. Rept. for 1891, Appendix No. 5.
2	1779, June.	6 19 E.	Capt. J. King.
3	1792—	6 E.	G. Sarycheff and F. P. Lütke.
4	{ 1804, Sept.	5 20 E.	A. J. von Krusenstern, site of village.
	{ 1804, Sept.	5 39 E.	" " " on Avatcha Bay.
	1809, June 23, July 23.	7 21 E.	Capt. Hagemeister. Not used.
	1825—	4 13 E.	Sir E. Sabine's Contributions. Supposed the same as Beechey's value below.
5	{ 1827, July.	4 13 E.	Capt. F. W. Beechey.
	{ 1827, Sept. 30.	3 43 E.	Capt. F. P. Lütke.
	{ 1827, Sept. 30.	4 06 E.	A. Erman.
	1829—	4 04 E.	Sir E. Sabine's Contributions. Supposed to refer to Erman's value.
6	1837, Sept. 4.	3 27 E.	Du Petit Thouars.
7	1849—	2 37 E.	Capt. H. Kellett.
8	1854, July.	3 40 E.	Frigate "Aurora."
	1856, Oct.	3 24 E.	Admiralty chart. Not used.
9	1866—	1 25 E.	K. S. Staritzki. Onazevich's collection.
10	1876, June 11, 13, Sept. 15.	1 09 E.	M. L. Onazevich.
11	1890—	0 31 W.	Prof. Stellingman. } Document in U. S. Hydrog. Office, Navy Department.
12	1892 —	1 10 W.	Lieut. Lachton, R.N. }

Secular variations of the magnetic declination, dip and intensity—Continued.

PETROPAVLOVSK, KAMCHATKA—Continued.

$D = -3°.43 + 5.10 \sin (0.85\, m + 11°.5)$. An uncertain expression.

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1728.5	—10.10	½	—8.53	+1.57	1849.5	—2.62		—2.45	+0.17
1779.5	6.31		7.24	—0.93	1854.5	3.67		2.08	+1.59
1792.5	6.00		6.53	—0.53	1866.5	1.42		1.23	+0.19
1804.7	5.49		5.75	—0.26	1876.6	—1.15		—0.57	+0.58
1827.6	4.07		4.10	—0.03	1890.5	+0.52	1½	—0.23	—0.29
1837.7	—3.45		—3.34	+0.11	1892.5	+1.16	1½	+0.33	—0.83

DIP AND INTENSITY AT PETROPAVLOVSK.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1779, June and Sept.	63 05	......	......	Capt. J. King.
2	1804, Sept.	63 32	......	......	A. J. von Krusenstern.
3	{ 1827, July.	64 02	......	......	Capt. F. W. Beechey.
	{ 1827, Sept. 30.	64 07	......	......	Capt. F. P. Lütke.
4	1829, Oct. 13.	63 49	......	0.5187 (?)	A. Erman.
5	1837, Sept. 4, 5.	64 05	0.2239	0.5123	Du Petit Thouars.
6	1854, July.	64 47	......	......	Frigate "Aurora."
7	1876, June 12, Sept. 15.	64 14	......	......	M. L. Onazevich.

$\Theta = 64°.28 + 0.008\,70\, m - 0.000\,134\, m^2$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1779.5	63.08	63.00	—0.08
1804.7	63.53	63.61	+0.08
1827.6	64.07	64.02	—0.05
1829.8	63.82	64.05	+0.23
1837.7	64.08	64.15	+0.07
1854.5	64.78	64.32	—0.46
1876.6	64.23	64.40	+0.17

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1770	—7.7	62.73
1780	7.2	63.02
1790	6.7	63.28
1800	6.1	63.51
1810	5.4	63.72
1820	4.7	63.90
1830	3.9	64.05
1840	3.2	64.18
1850	2.4	64.28
1860	1.7	64.35
1870	1.0	64.40
1880	—0.4	64.42
1890	+0.2	64.41
1900	+0.7	64.38

(See diagram of secular variation of a freely suspended needle, Pl. C.)

NOOTKA, VANCOUVER ISLAND, B. C.

$\varphi = 49°\ 35'.5$ $\lambda = 126°\ 37'.5$ W. of Gr.

[Friendly Cove.]

No.	Date.	D.	References and remarks.
		° ′	
1	{ 1778, Apr. 4.	19 45 E.	Capt. J. Cook.
	{ 1778—	17 49 E.	" " " in Nootka Sound. Chart facing page 1757 of Vol. V, of Cook's Voyages. London, 1790.
2	1783.3	17 54 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
3	1786, Aug. 25, 26.	19 47 E.	La Perouse. Offshore.
	1791, Aug. 16, 17, Sept. 4.	22 30 E.	Don A. Malaspina. Not used.
4	1792, Oct.	18 22 E.	Capt. G. Vancouver.
5	1860—	23 47 E.	Capt. G. H. Richards, in Friendly Cove.
6	1863—	23 05 E.	" " " " " " "
7	1881, Sept. 27.	23 36 E.	Lieut. H. E. Nichols, U. S. N., in Friendly Cove.

Secular variations of the magnetic declination, dip and intensity—Continued.

NOOTKA, VANCOUVER ISLAND, B. C.—Continued.

$D = 21°.25 + 2.74 \sin (1.30\, m - 152°.0)$

Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°
1778·2	−18·78		−18·76	+0·02
1783·3	17·91		18·91	−1·00
1786·6	19·78		19·02	+0·76
1792·8	18·37		19·27	−0·90
1860·5	23·78		23·07	+0·71
1863·5	23·08		23·21	−0·13
1881·7	−23·60		−23·81	−0·21

DIP AND INTENSITY AT NOOTKA, VANCOUVER ISLAND.

No.	Date.	θ.		H.	F.	References.
		°	′			
1	1778, Apr.	72	29	......	......	Capt. J. Cook. In Resolution Cove.
2	1791, Aug. 16, 17.	70	20·7	......	......	Don A. Malaspina.
3	1792, Oct.	73	56	......	......	Capt. G. Vancouver.
4	1881, Sept. 26, 27.	71	33·0	0·1883	0·5948	Lieut. H. E. Nichols, U. S. N. In Friendly Cove.

CAPE FLATTERY AND NEAH BAY, WASHINGTON.

$\varphi = 48° 23'.5$ $\lambda = 124° 44'.1$ W. of Gr.

[Light-house on Tatoosh Island.]

No.	Date.	D.		References and remarks.
		°	′	
1	1783—	17	15 E.	Deduced from a discussion of 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1788, Aug. 15.	19	14 E.	C. Duncan.
3	1792, Apr. 30.	18	E.	Capt. G. Vancouver.
4	1841—	22	30 E.	Chart of Wilkes' Exploring Expedition.
5	1852, Aug. 17–23.	21	30 E.	G. Davidson. U. S. Coast S. At Scarboro Harbor.
6	1855, Aug. 13–18.	21	48 E.	Lieut. W. P. Trowbridge, U. S. Coast S. On Neah Bay.
7	1881, Oct. 11.	22	44 E.	H. E. Nichols, U. S. N. On Neah Bay.
8	1893·7	23	26 E.	J. J. Gilbert, U. S. Coast & G. S. Mean of observations at Waadah, —23° 26′ in $\varphi = 48° 23'.1$, $\lambda = 124° 35'.9$; at Classet, —23° 06′ in $\varphi = 48° 23'.5$, $\lambda = 124° 39'.5$, and Tatoosh, —23° 45′ in $\varphi = 48° 23'.5$, $\lambda = 124° 44'.0$.

$D = -19°.88 + 3.38 \sin (1.10\, m - 149°.4)$

Date.	Obs'd D.	p.	Comp'd D.	C − O.
	°		°	°
1783·3	−17·25		−17·58	−0·33
1788·6	19·23	¼	17·85	+1·38
1792·3	18·00		18·08	−0·08
1841·5	22·50	¼	21·10	+1·40
1852·6	21·50		21·75	−0·25
1855·6	21·80		21·91	−0·11
1881·8	22·74		22·96	−0·22
1893·7	−23·43		−23·20	+0·23

Secular variations of the magnetic declination, dip and intensity—Continued.

CAPE FLATTERY AND NEAH BAY, WASHINGTON—Continued.

DIP AND INTENSITY AT CAPE FLATTERY AND NEAH BAY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1852, Sept. 7, 8.	....	0·1923	......	G. Davidson and J. Rockwell, U. S. Coast S. In Scarboro Harbor.
2	1855, Aug. 13–22.	71 07.0	0·1972	0·6092	Lieut. W. P. Trowbridge. U. S. Coast S. Near Waadah Island, Neah Bay.
3	1881, Oct. 10, 11.	71 04·4	0·1911	0·5892	H. E. Nichols, U. S. N. Neah Bay.

PORT TOWNSEND, WASH.

$\varphi = 48° 07'·1$ $\lambda = 122° 45'·3$ W. of Gr.

[Marine Hospital.]

No.	Date.	D.	References and remarks.
		° ′	
1	1783·3	17·0 E.	Deduced from 122 observations made by Spanish navigators along the coast between San Blas and Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
	1792, May.	21½ E.	Capt. G. Vancouver. Not used.
2	1841—	20 40 E.	Chart of Wilkes' Exploring Expedition.
3	1856, Aug. 17–20.	21 40 E.	G. Davidson, U. S. Coast S.
4	1857—	21 54 E.	S. Garfielde. Reduction to Port Townsend + 8′.
	1859—	20 45 E.	Reference as above. Not used.
5	1862—	22 00 E.	Reference as above. At Mill.
6	1876, Feb.	21 59 E.	Capt. G. H. Burden.
7	1881, Nov. 16, 17, 18.	21 26·9 E.	J. S. Lawson, U. S. Coast & G. S.
8	1888, July 19, 20.	22 48·8 E.	E. Smith, " " " Near Marine Hospital.
9	1894, Nov. 15–21.	22 50·9 E.	J. J. Gilbert, " " " " " "

$$D = -18°·80 + 3·85 \sin(1·0\, m - 140°·9)$$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1783·3	—17·00	½	—17·02	—0·02
1841·5	20·76		20·76	—0·09
1856·6	21·66		21·56	+0·10
1857·5	21·77		21·60	+0·17
1862·5	22·00		21·82	+0·18
1876·1	21·98		22·29	—0·31
1881·9	21·45	½	22·44	—0·99
1888·5	22·81		22·56	+0·25
1894·9	—22·85		—22·63	+0·22

DIP AND INTENSITY AT PORT TOWNSEND.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1792, May.	74 30	......	......	Capt. G. Vancouver. At Port Discovery.
2	1881, Nov. 17, 18.	....	0·1911	......	J. S. Lawson, U. S. Coast & G. S.
3	1888, July 19, 20.	71 07·9	0·1901	0·5880	E. Smith, U. S. Coast & G. S., Marine Hospital Grounds.
4	1894, Nov. 16–21.	71 14·8	0·1847	0·5745	J. J. Gilbert, U. S. Coast & G. S., Marine Hospital Grounds.

Secular variations of the magnetic declination, dip and intensity—Continued.

SEATTLE, WASH.

$\varphi = 47° 36'.6$ $\lambda = 122° 20'.1$ W. of Gr.

[Astronomic station of 1888.]

No.	Date.	D.	References and remarks.
		° ′	
1	1783.3	16 45 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1792, May.	19 36 E.	Capt. G. Vancouver, at Restoration Point in $\varphi = 47° 30'$, $\lambda = 122° 14'$. Voyage of Discovery, London, 1798.
3	1841—	21 53 E.	Wilkes' Exploring Expedition. Chart of Elliott Bay No. 160, in $\varphi = 47° 35'.7$, $\lambda = 122° 21'.5$.
4	1855—	21 25 E.	S. Garfielde.
5	1871, Sept. 27–Oct. 3.	22 35 E.	S. R. Throckmorton, U. S. Coast S.
6	1881, Nov. 8–11.	22 02.5 E.	J. S. Lawson, " " " & G. S.
7	1888, July 9, 10, 11.	22 29.1 E.	E. Smith, " " " " " "
8	1894, May 23, 24, 25.	22 40.9 E.	G. Davidson, " " " " " " At University Block.

$$D = -19°.25 + 3.24 \sin (0.90\, m - 131°.3)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1783.3	—16.75	¼	—18.62	—1.87
1792.4	19.60		19.08	+0.52
1841.5	21.88	½	21.38	+0.50
1855.5	21.42		21.86	—0.44
1871.8	22.59	¾	22.26	+0.33
1881.8	22.04		22.41	—0.37
1888.5	22.48		22.47	+0.01
1894.4	—22.68	1½	22.49	+0.19

DIP AND INTENSITY AT SEATTLE.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1871, Sept. 21, Oct. 4, 5.	71 08.9	0.1961	0.6068	S. R. Throckmorton, U. S. Coast S.
2	1881, Nov. 10, 11.	....	0.1944	......	J. S. Lawson, " " " & G. S.
3	1888, July 9, 10, 11.	70 52.8	0.1935	0.5908	E. Smith, U. S. Coast & G. S. University Grounds.
4	1894, May 24, 25.	....	0.1932	......	G. Davidson, U. S. Coast & G. S. University Grounds.
5	1895, Feb. 13.	70 50.3	......	......	J. J. Gilbert, U. S. Coast & G. S. University Grounds.

OLYMPIA, WASH.

$\varphi = 47° 02'$ $\lambda = 122° 54'$ W. of Gr.

No.	Date.	D.	References.
		° ′	
1	1783.3	16 35 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1853—	21 15 E.	S. Garfielde.
3	1856.5	20 47 E.	Sir E. Sabine, communication XIII.
4	1881, Nov. 2, 3, 4.	21 34.6 E.	J. S. Lawson, U. S. Coast & G. S.
5	1884, Dec. 13, 14, 15, 17.	22 43.3 E.	J. J. Gilbert, U. S. Coast & G. S., at Howard station in $\varphi = 47° 03'.3$, $\lambda = 122° 53'.4$.

Secular variations of the magnetic declination, dip and intensity—Continued.

OLYMPIA, WASH.—Continued.

$D = -18°{\cdot}87 + 3{\cdot}66 \sin(1{\cdot}0\, m - 151°{\cdot}0)$

Date.	Obs'd D.		Comp'd D.	C — O.
	°		°	°
1783·3	−16·58	½	−16·65	−0·07
1853·5	21·25		20·82	+0·43
1856·5	20·78		20·99	−0·21
1881·8	21·58		22·09	−0·51
1894·9	−22·72		−22·37	+0·35

DIP AND INTENSITY AT OLYMPIA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1881, Nov. 4	....	0·1975	......	J. S. Lawson, U. S. Coast & G. S.
2	1894, Dec. 13–17.	70 26·4	0·1976	0·5902	J. J. Gilbert, " " At Howard station.

CAPE DISAPPOINTMENT, WASHINGTON.

$\varphi = 46°\ 16'{\cdot}7 \qquad \lambda = 124°\ 02'{\cdot}8$ W. of Gr.

[South shore of Baker Bay.]

No.	Date.	D.	References and remarks.
		° ′	
1	1783·3	16 23 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1786, Sept. 1, 2.	18 E.	La Perouse.
3	1792, Apr. 27.	18 E.	Capt. G. Vancouver.
4	1839—	19 11 E.	Sir E. Belcher.
	1841—	18 41·1 E.	Wilkes' Exploring Expedition, chart No. 136. In $\varphi = 46°\ 16'$ and $\lambda = 124°\ 01'{\cdot}7$. Not used.
5	1842—	20 E.	Duflot de Mofras.
6	1851, July 5–9.	20 19·1 E.	G. Davidson, U. S. Coast Survey. On beach.
	1851, July 14–19.	20 45·3 E.	" " On top of cape. Not used.
7	1858—	21 E.	S. Garfielde.
8	1873, Oct. 24–27.	21 26·5 E.	W. Eimbeck, U. S. Coast S. On beach.
	1873, Oct. 19–23.	21 46·9 E.	" " On top of cape. Not used.
9	1831, Oct. 14.	21 36·0 E.	Lieut. H. E. Nichols, U. S. N. On beach.
10	1895, Feb. 24–27.	21 55·8 E.	J. J. Gilbert, U. S. Coast & G. S. Station on beach, as in 1881.

$D = -19°{\cdot}39 + 2{\cdot}54 \sin(1{\cdot}25\, m - 158°{\cdot}7)$

Date.	Obs'd D.	p.	Comp'd D.	C — O.
	°		°	°
1783·3	−16·39		−17·15	−0·76
1786·7	18·00		17·24	+0·76
1792·3	18·00		17·42	+0·58
1839·5	19·18		19·75	−0·57
1842·5	20·00		19·91	+0·09
1851·5	20·32		20·39	−0·07
1858·5	21·00		20·73	+0·27
1873·8	21·44		21·37	+0·07
1881·8	21·60		21·61	−0·01
1895·1	−21·93		−21·87	+0·06

Secular variations of the magnetic declination, dip and intensity—Continued.

CAPE DISAPPOINTMENT, WASHINGTON—Continued.

DIP AND INTENSITY AT CAPE DISAPPOINTMENT.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1830, Sept. and Dec.	69 30·3	......	......	D. Douglas.
2	1839—	69 26·9	......	......	Sir E. Belcher. On Baker's Bay, landing place.
3	1873, Oct. 22-20.	69 13·7	0·2092	0·5899	W. Eimbeck, U. S. Coast S. On beach.
4	1881, Oct. 13-15.	69 17·7	0·2067	0·5846	Lieut. H. E. Nichols, U. S. N. " "
5	1895, Feb. 23-26.	69 16·5	0·2064	0·5833	J. J. Gilbert, U. S. Coast & G. S. On beach.

WALLAWALLA, WASH.

$\varphi = 46° \ 03'\cdot 9$ $\lambda = 118° \ 20'\cdot 8$ W. of Gr.

[Astronomic station near court-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1853—	19 40 E.	Gov. J. J. Stevens, at Old Fort. Reduction to Wallawalla −0°·84.
2	1860—	20 30 E.	S. Garfielde.
	1860—	20 00 E.	J. Mullan, U. S. A.
3	1861—	20 30 E.	S. Garfielde, at Old Fort. Reduction to Wallawalla −0°·84.
4	1881, Sept. 24, 25, 26.	22 04·4 E.	J. S. Lawson, U. S. Coast & G. S.
	1881, Sept. 29, 30, Oct. 1-2.	19 55·7 E.	" " Near Old Fort. Reduction −0°·84.
5	1887, Sept. 16, 17, 19.	21 10·3 E.	E. Smith, U. S. Coast & G. S. Court-house block.

$D = -17°\cdot 07 + 4\cdot 25 \sin (1\cdot 3 \, m - 131°\cdot 5)$. Very uncertain.

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1853·0	−20·51		−20·43	+0·08
1860·5	20·25		20·82	−0·57
1861·5	21·34		20·87	+0·47
1881·7	21·42		21·32	+0·10
1887·9	−21·17		−21·28	−0·11

DIP AND INTENSITY AT WALLAWALLA.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1830, July.	70 14 + 21·6	0·2005 — 42	0·5929 — 21	D. Douglas. Near Old Fort. Reduction to Wallawalla as indicated.
2	1881, Sept. 25, 26.	70 46·5	0·2005	0·6089	J. S. Lawson, U. S. Coast & G. S. At town, court-house block.
3	1887, Sept. 16-20.	70 41·2	0·1984	0·5998	E. Smith, U. S. Coast & G. S. At town, court-house block.

Secular variations of the magnetic declination, dip and intensity—Continued.

VANCOUVER, WASH.

$\varphi = 45° 37'.5$ $\lambda = 122° 39'.7$ W. of Gr.

[Flagstaff at Fort Vancouver.]

No.	Date.	D.	References and remarks.
		° ′	
1	1788, Aug. 14.	14 26 E.	Gray. Reduction to Vancouver about − 8′.
2	1839—	19 22 E.	Sir E. Belcher.
3	1859-	21 30 E.	S. Garfielde.
4	1860—	20 05 E.	Capt. R. W. Haig.
5	1881, Oct. 26, 27.	20 53.3 E.	J. S. Lawson, U. S. Coast & G. S. South of Old Fort.
6	1895, Mar. 1, 2, 3, 4.	21 32.4 E.	J. J. Gilbert, " " " Near station of 1881. In $\varphi = 45° 37'.5$, $\lambda = 122° 39'.8$.

$$D = -17°.50 + 3.96 \sin (1.20\, m - 141°.3)$$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°
1788.6	−14.57	½	−15.23	−0.66
1839.5	19.37		19.24	+0.13
1859.5	21.50		20.54	+0.96
1860.5	20.08		20.59	−0.51
1881.8	20.89		21.36	−0.47
1895.2	−21.54		−21.46	+0.08

DIP AND INTENSITY AT VANCOUVER.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1830, Nov.	69 39.7	0.2048 (?)	0.5893 (?)	D. Douglas. At Fort Vancouver.
2	1839—	69 22.2	0.2063	0.5855	Sir E. Belcher. At Fort, garden.
3	1860, May 3.	69 17.4	0.2129	0.6020	Capt. R. W. Haig. At Fort.
4	1881, Oct. 26, 27.	....	0.2097	......	J. S. Lawson, U. S. Coast & G. S. South of Old Fort.
5	1895, Mar. 1–4.	69 17.0	0.2091	0.5911	J. J. Gilbert, U. S. Coast & G. S. South of Old Fort.

PORTLAND, OREGON.

$\varphi = 45° 31'.1$ $\lambda = 122° 40'.8$ W. of Gr.

[Custom-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1783.3	16 E.	Deduced from 122 observations made by Spanish navigators between San Blas and Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1858.5	20 E.	Sir E. Sabine's contribution XIII, to Terr. Mag. Phil. Trans. Roy. Soc., 1872.
3	1870, Aug. 19, 23.	22 21 E.	G. Davidson, U. S. Coast S. In $\varphi = 45° 31'.2$, $\lambda = 122° 41'$.
4	1880, Apr. 30.	22 53 E.	W. H. Dall and M. Baker, U. S. Coast & G. S. In $\varphi = 45° 31'.5$, $\lambda = 122° 40'.5$.
5	1881, Aug. 4, 5, 6.	22 12 E.	J. S. Lawson, U. S. Coast & G. S. In $\varphi = 45° 31'.2$, $\lambda = 122° 42'.6$.
6	1886, June 17, 18, 19, 20.	22 07.8 E.	G. Davidson, " " " Station of 1881.
	1887--	22 30 E.	Surveyor-General of Oregon. Station of 1891. Communicated by W. Thiel, July 20, 1888. [Not used—Sch.]
7	1887, June 24, 25, 27.	22 00.0 E.	E. Smith, U. S. Coast & G. S. Custom-house square $\varphi = 45° 31'.1$, $\lambda = 122° 40'.8$.
8	1888, June 12, 13, 14.	21 42.5 E.	R. A. Marr, U. S. Coast & G. S. Station of 1887, custom-house square.
9	{ 1895, Feb. 20, 21, 22.	22 24.5 E.	J. J. Gilbert, U. S. Coast & G. S. Custom-house square.
	{ 1895, Mar. 6, 7, 8.	22 11.4 E.	" " " " In City Park, $\varphi = 45° 31'.4$, $\lambda = 122° 42'.2$.

Secular variations of the magnetic declination, dip and intensity—Continued.

PORTLAND, OREGON—Continued.

$D = -19°.05 + 3.41 \sin(1.3m - 159°.1)$. Approximate expression.

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°
1783.3	—16.00		—15.94	+0.06
1858.5	20.00		20.85	—0.85
1870.6	22.35		21.57	+0.78
1880.3	22.88		22.01	+0.87
1881.6	22.20		22.06	+0.14
1886.5	22.13		22.22	—0.09
1887.5	22.00		22.25	—0.25
1888.4	21.71		22.27	—0.56
1895.2	—22.30		—22.41	—0.11

DIP AND INTENSITY AT PORTLAND.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1858, July.	69 31	......	......	D. Douglas.
2	1880, May 1.	69 35.6	0.2035	0.5837	W. H. Dall and M. Baker, U. S. Coast & G. S. West of Clarendon Hotel.
3	1881, Aug. 5, 6.	69 24.2	0.2069	0.5882	J. S. Lawson, U. S. Coast & G. S. In court-house block.
4	1886, June 17–19.	....	0.2056	......	G. Davidson, U. S. Coast & G. S. In court-house block.
5	1887, June 24–28.	69 24.1	0.2061	0.5859	E. Smith, U. S. Coast & G. S. In court-house square.
6	1888, June 12–14.	69 29.6	0.2061	0.5884	R. A. Marr, U. S. Coast & G. S. In court-house square.
7	1895, Feb. 20–22.	69 31.5	0.2043	0.5840	J. J. Gilbert, U. S. Coast & G. S. In court-house square.
	1895, Mar. 6–8.	68 48.7	0.2165	0.5990	J. J. Gilbert, U. S. Coast & G. S. In City Park. Apparently a disturbed locality.

SALT LAKE CITY, UTAH.

$\varphi = 40° 46'.1 \qquad \lambda = 111° 53'.8$

[Astronomic station, Temple Square.]

No.	Date.	D.	References and results.
		° ′	
1	1850—	15 34 E.	Maj. W. H. Emory.
2	1866, Aug.	16 30 E.	J. W. Fox.
3	1869, May 6–15.	16 36.4 E.	G. W. Dean and F. H. Agnew, U. S. Coast S.
4	1872—	17 01 E.	Report of Chief of Engineers, U. S. A.
5	1878, Aug. 15.	16 48.1 E.	Dr. T. E. Thorpe.
	1878, Oct. 26, 28, 29.	16 44.2 E.	J. B. Baylor, U. S. Coast & G. S.
6	1881, May 12, 13, 14.	16 28.4 E.	
7	1883, Nov. 15, 16, 17.	16 14.1 E.	
8	1884, Oct. 22, 23, 24.	16 13.6 E.	W. Eimbeck, U. S. Coast & G. S.
9	1885, Nov. 5–10.	16 29.3 E.	
10	1887, Nov. 8–11.	16 30.6 E.	
11	1892, May 26–30.	16 34.7 E.	R. L. Faris, U. S. Coast & G. S., at Waddoup, $\varphi = 40° 54'.3$, $\lambda = 111° 53'.2$. Reduction to Temple Square, about +8′.
12	1893, June 9–10.	16 17.0 E.	W. Eimbeck, U. S. Coast & G. S. At Temple Square station.
	1893, June 6, 7, 8.	16 27.1 E.	R. L. Faris, " " " At Salt Lake University, $\varphi = 40° 46'.4$, $\lambda = 111° 54'.1$.

Secular variations of the magnetic declination, dip and intensity—Continued.

SALT LAKE CITY, UTAH—Continued.

$D = -12°.50 + 4.11 \sin (1.3\, m - 126°.4)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1850·5	—15·57	½	—15·83	—0·26	1883·9	—16·24		—16·57	—0·33
1866·6	16·50		16·47	+0·03	1884·8	16·23		16·56	—0·33
1869·4	16·61		16·53	+0·08	1885·9	16·49		16·54	—0·05
1872·5	17·02		16·58	+0·44	1887·9	16·51		16·51	0·00
1878·7	16·77		16·61	+0·16	1892·4	16·44		16·39	+0·05
1881·4	—16·47		—16·60	—0·13	1893·4	—16·45		—16·36	+0·09

DIP AND INTENSITY AT SALT LAKE CITY.

No.	Date.	Θ.	H.	F.	Referencess.
		° ′			
1	1869, May 6–19.	66 58·2	0·2326	0·5946	G. W. Dean and F. H. Agnew, U. S. Coast S. In Temple Square.
2	1878, Aug. 14, 15.	67 02·3	0·2308	0·5916	Dr. T. E. Thorpe. East of President's house.
	1878, Oct. 25–31.	67 05·9	0·2299	0·5908	J. B. Baylor, U. S. Coast & G. S. On Fourth Temple st.
3	1881, May 12–14.	67 02·1	0·2308	0·5915	W. Eimbeck and R. A. Marr, U. S. Coast & G. S. Temple block.
4	1883, Nov. 15–17.	67 01·2	0·2293	0·5873	W. Eimbeck and G. F. Bird, U. S. Coast & G. S. Temple block.
5	1884, Oct. 22–24.	67 05·2	0·2295	0·5895	W. Eimbeck and G. F. Bird, U. S. Coast & G. S. Temple block.
6	1885, Nov. 5–10.	67 01·0	0·2303	0·5895	W. Eimbeck and G. F. Bird, U. S. Coast & G. S. Temple block.
7	1887, Nov. 8–14.	67 03·4	0·2303	0·5908	W. Eimbeck and J. H. Turner, U. S. Coast & G. S. Temple blook.
8	1893, June 6–8.	67 05·2	0·2291	0·5884	R. L. Faris, U. S. Coast & G. S. University.

Between the years 1878 and 1893 the dip appears to have been nearly unchanged. The value of Θ for this period is 67° 03′·3.

$H = 0.2347 - 0.000\,134\, m$

Date.	Obs'd H.	Comp'd H.	C—O.
1869·4	0·2326	0·2321	—0·0005
1878·7	0·2303	09	+ 6
1881·4	0·2308	05	— 3
1883·9	0·2293	02	+ 9
1884·8	0·2295	0·2301	+ 6
1885·8	0·2303	0·2299	— 4
1887·8	0·2303	97	— 6
1893·4	0·2291	0.2289	—0·0002

Secular variations of the magnetic declination, dip and intensity—**Continued.**

CAPE MENDOCINO, CAL.

$\varphi = 40°\ 26'\cdot3 \qquad \lambda = 124°\ 24'\cdot3$ W. of Gr.

[Light-house.]

No.	Date.	D. °	′		References and remarks.
	1579 (?).	9		E.	Sir F. Drake. Not used.
	1693—	2			G. F. G. Carreri. Defective value, not used.
1	1783·3	14	10	E.	Deduced from 122 observations by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1786, Sept. 7, 8.	14	54	E.	La Perouse.
3	1792, Apr. 18.	16		E.	Capt. G. Vancouver. Reduction to the cape, about —0°.25
	1792, Apr. 19.	15		E.	" " " " " —0°·20
	1792, Apr. 22.	16		E.	" " " " " +0°·10
4	1794, Oct. 3.	14		E.	" " " " " +0°·12
5	1854, Apr. 25 to May 2.	17	04·5	E.	G. Davidson, U. S. Coast S. Reduction to the cape, about +0°·15.
6	1896, Apr. 7, 8, 9, 10.	18	00·5	E.	G. Davidson and F. Morse, U. S. Coast & G. S. Near the light-house.

$D = -15°\cdot25 + 2\cdot45 \sin(1\cdot10\, m - 128°\cdot0)$. Very uncertain.

Date.	Obs'd D. °	p.	Comp'd D. °	C — O °
1783·3	—14·17		—14·36	—0·19
1786·7	14·90		14·51	+0·39
1792·3	15·78		14·77	+1·01
1794·7	13·88		14·88	—1·00
1854·3	16·93		17·30	—0·37
1886·3	—18·01		—17·70	+0·31

DIP AND INTENSITY AT CAPE MENDOCINO.

No.	Date.	Θ. °	′	H.	F.	References.
1	1886, Apr. 7–10.	64	23·7	0·2403	0·5560	G. Davidson and F. Morse, U. S. Coast & G. S. Near light-house.

SAN FRANCISCO, CAL.

$\varphi = 37°\ 47'\cdot5 \qquad \lambda = 122°\ 27'\cdot3$

[Presidio.]

No.	Date.	D. °	′		References and remarks.
1	1783·3	12	55	E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1792, Nov. 20.	12	48	E.	Capt. G. Vancouver. On board ship.
	1816, Oct.	16	05	E.	Von Kotzebue. Not used.
3	1818, Sept. 20 (o. s.).	15		E.	V. M. Golovnin.
	1824—	16		E.	Von Kotzebue. Not used.
4	1827—	15	27	E.	Capt. F. W. Beechey.
5	1829, Dec. 6.	14	55	E.	A. Erman.
6	1830—	14	51	E.	
7	1837—	15	20	E.	Sir E. Belcher.
	1837—	15	00	E.	Du Petit Thomas.
8	1839—	15	20	E.	Sir E. Belcher.
9	1841, Oct.	15	30	E.	Duflot de Mofras.
	1842, Jan.	15	30	E.	

Secular variations of the magnetic declination, dip and intensity—Continued.

SAN FRANCISCO, CAL.—Continued.

No.	Date.	D.	References and remarks.
		° ′	
10	1849–50.	15 41 E.	Com. Ringgold, U. S. N. On Alcatraz Island.
11	1852, Feb. 18–28.	15 27·6 E.	G. Davidson, U. S. Coast S. All observations by G. Davidson were made at Presidio of San Francisco.
	1852, Mar. 24.	15 28·8 E.	
	1852, Apr. 21.	15 27·8 E.	
	1852, May 28.	15 31·1 E.	
12	1858, June 3–8.	15 49·4 E.	K. Friesach. Dupont street, near Catholic Church.
	1858, June 10–12.	15 56·2 E.	K. Friesach. Stockton and California streets.
13	1866, June 26.	16 25·5 E.	Prof. W. Harkness, U. S. N. On Yerba Buena Island.
14	1871, Dec. 14, 15, 16.	16 23·1 E.	All observations since 1871 at Presidio.
15	1872, Oct. 26, 27, 28.	16 25·7 E.	G. Davidson, U. S. Coast S.
16	1873, June 25, 26, 27.	16 25·4 E.	
	1873, Aug. 19–23.	16 24·0 E.	
	1873, Nov. 12–16.	16 25·4 E.	
17	1874, Jan. 10–14. 1874, Feb. 19, 20, 21.	16 26·9 E.	
18	1879, Mar. 12–15.	16 34·0 E.	G. Davidson and B. A. Colonna, U. S. Coact & G. S.
19	1880, Sept. 25–26.	16 28·3 E.	Lieut. H. E. Nichols, U. S. N.
	1880, Nov. 20.	16 39·5 E.	W. H. Dall and M. Baker, U. S. Coast & G. S.
20	1881, Mar. 30, 31, Apr. 1.	16 33·3	W. Eimbeck, " " " "
	1881, Apr. 26, 27.	16 31·9	Lieut. H. E. Nichols, U. S. N.
	1881, July 12, Nov. 1.	16 32·2	
	1881, June 22, 23, 24, Dec. 1, 2, 3.	16 18·2	J. S. Lawson, U. S. Coast & G. S.
21	1883, June 3.	16 38·6 E.	R. A. Marr, U. S. Coast & G. S.
22	1884, Sept. 5–16.	16 32·3 E.	G. Davidson, U. S. Coast & G. S.
23	1885, Aug. 4–12.	16 33·4 E.	
24	1886, Apr. 21–24.	16 33·1 E.	
25	1887, Nov. 15–19.	16 33·9 E.	
26	1888, May 28–31.	16 33·9 E.	
27	1889, Apr. 24–29, May 1.	16 36·3 E.	
28	1890, Oct. 18–27.	16 38·3 E.	J. J. Gilbert, U. S. Coast & G. S. (G. Davidson, in charge).
29	1891, Sept. 29, 30, Oct. 1.	16 39·7 E.	F. Morse, U. S. Coast & G. S. (G. Davidson, in charge).
30	1892, Nov. 3–8.	16 40·5 E.	
31	1893, Mar. 28, 29, 30.	16 40·7 E.	
	1893, Nov. 29, Dec. 4–5.	16 42·6 E.	
32	1894, Oct. 30, 31, Nov. 1.	16 44·6 E.	
33	1896, Jan. 7, 8, 9.	16 46·2 E.	F. Morse, U. S. Coast & G. S.

$$D = -13^\circ{\cdot}73 + 2{\cdot}94 \sin(0{\cdot}95\, m - 135^\circ{\cdot}3) + 0{\cdot}056 \sin(20\, m + 87^\circ)$$

[N. B.—The second periodic term applies after 1872.]

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	C—O.*
	°		°	°		°		°	°	°
1783·3	−12·91		−12·81	+0·10	1874·0	−16·45		−16·45	0·00	−0·03
1792·9	12·80		13·27	−0·47	1879·2	16·57		16·53	+0·04	0·00
1818·7	15·00		14·50	+0·50	1880·8	16·56		16·56	0·00	−0·02
1827·5	15·45		14·90	+0·55	1881·5	16·48		16·56	−0·08	−0·08
1829·9	14·92		15·01	−0·09	1883·4	16·64		16·59	+0·05	+0·08
1830·5	14·85		15·03	−0·18	1884·7	16·54		16·60	−0·06	−0·01
1837·5	15·17		15·33	−0·16	1885·6	16·56		16·61	−0·05	0·00
1839·5	15·33		15·41	−0·08	1886·3	16·55		16·62	−0·07	−0·01
1841·9	15·50		15·50	0·00	1887·9	16·56		16·63	−0·07	−0·02
1850·0	15·68		15·80	−0·12	1888·4	16·57		16·63	−0·06	−0·02
1852·3	15·48		15·88	−0·40	1889·3	16·60		16·64	−0·04	−0·01
1858·4	15·88		16·07	−0·19	1890·8	16·64		16·65	−0·01	−0·01
1866·5	16·42		16·28	+0·14	1891·7	16·66		16·66	0·00	−0·02
1871·9	16·38		16·41	−0·03	1892·8	16·67		16·66	+0·01	−0·03
1872·8	16·43		16·42	+0·01	1893·6	16·69		16·66	+0·03	−0·02
1873·7	−16·41		−16·44	−0·03	1894·8	16·74		16·67	+0·07	+0·01
					1896·0	−16·77		−16·67	+0·10	+0·05

* When second periodic term is applied.

Secular variations of the magnetic declination, dip and intensity—Continued.

SAN FRANCISCO, CAL.—Continued.

DIP AND INTENSITY AT SAN FRANCISCO.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1815, Nov. 1.	62 46	......	......	Von Kotzebue.
2	1829—	....	......	0·5533 (?)	A. Erman.
3	1831, Feb.	62 58 (?)	0·2534 (?)	0·5574 (?)	D. Douglas.
4	1837—	61 53·8	......	......	Sir E. Belcher.
5	1839—	62 05·8	0·2547	0·5445	" "
6	1852, Feb. 11, 12.	62 21·2	......	......	F. A. Roe and G. Davidson. At Presidio.
7	1858, June 5–13.	62 47	0·2571	0·5621	Karl Friesach. Mean value from two localities—Dupont and California streets.
8	1866, Jnne 26.	62 22	0·2602	0·5610	Prof. W. Harkness, U. S. N. On Yerba Buena Island.
9	1873, Nov. 13–20.	62 05·1	0·2556	0·5460	G. Davidson and S. R. Throckmorton, U. S. Coast S. At Presidio.
10	1880, Apr. 12–22; Sept. 24–26; Nov. 16–19.	62 18·9	0·2542	0·5471	W. H. Dall and M. Baker, U. S. Coast & G. S. At Presidio. H. E. Nichols, U. S. N.
11	1881, Apr.–Dec.	62 26·5	0·2539	0·5488	Wm. Eimbeck, R. A. Marr, U. S. Coast & G. S., and H. E. Nichols, U. S. N. At Presidio.
12	1882, Apr. 17, 18.	62 25·5	......	......	J. S. Lawson, U. S. Coast & G. S. At Presidio.
13	1883, June 2–5	....	0·2527	......	R. A. Marr, " " " " "
14	1884, Sept. 5–24.	62 20·2	0·2529	0·5448	G. Davidson and F. Morse, U. S. Coast & G. S. At Presidio.
15	1885, Aug. 4–12.	....	0·2530	......	G. Davidson and F. Morse, U. S. Coast & G. S. At Presidio.
16	1886, Apr. 21–24.	62 16·6	0·2529	0·5437	F. Morse, U. S. Coast & G. S. At Presidio.
17	1887, Nov. 15–19.	62 25·0	0·2529	0·5462	" " " " " " "
18	1888, May 28–31.	62 23·4	0·2528	0·5454	" " " " " " "
19	1889, Apr. 24, May 1.	62 24·2	0·2526	0·5453	" " " " " " "
20	1890, Oct. 18–22.	62 28·7	0·2533	0·5482	J. J. Gilbert, " " " " "
21	1891, Sept. 29–Oct. 1.	62 30·2	0·2520	0·5458	F. Morse, " " " " "
22	1892, Nov. 3–8.	62 28·2	0·2517	0·5446	" " " " " " "
23	1893, Mar. 28–30.	62 29·5	0·2511	0·5437	" " " " " " "
24	1894, Oct. 30–Nov. 1.	62 29·0	0·2514	0·5442	" " " " " " "
25	1896, Jan. 7, 8, 9.	62 28·3	0·2522	0·5457	" " " " " " "

Omitting values of 1815 and 1831, the remaining 20 observations give:

$$\Theta = 62^\circ{\cdot}239 + 0{\cdot}011\,3\,m - 0{\cdot}000\,168\,m^2$$
$$H = 0{\cdot}256\,83 - 0{\cdot}000\,090\,5\,m - 0{\cdot}000\,005\,10\,m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C — O.
	°	°	°
1837·5	61·90	62·07	+0·17
1839·5	62·10	62·10	0·00
1852·1	62·35	62·26	—0·09
1858·4	62·78	62·32	—0·46
1866·5	62·37	62·38	+0·01
1873·9	62·08	62·41	+0·33
1880·7	62·32	62·43	+0·11
1881·5	62·44	62·43	—0·01
1882·3	62·42	62·43	—0·01
1884·7	62·34	62·43	+0·09
1886·3	62·28	62·43	+0·15
1887·9	62·42	62·42	0·00
1888·4	62·39	62·42	+0·03
1889·3	62·40	62·42	+0·02
1890·8	62·48	62·42	—0·06
1891·7	62·50	62·42	—0·08
1892·8	62·47	62·41	—0·06
1893·6	62·50	62·41	—0·09
1894·8	62·48	62·41	—0·07
1896·0	62·47	62·40	—0·07

Date.	Obs'd H.	Comp'd H.	C — O.
1831·1	0·2534	0·2533	—0·0001
1839·5	547	553	+ 6
1858·4	571	572	+ 1
1866·5	602	569	— 33
1873·9	556	561	+ 5
1880·7	542	548	+ 6
1881·5	539	546	+ 7
1883·4	527	541	+ 14
1884·7	529	538	+ 9
1885·6	530	536	+ 6
1886·3	529	534	+ 5
1887·9	529	529	0
1888·4	528	528	0
1889·3	526	525	— 1
1890·8	533	521	— 12
1891·7	520	517	— 3
1892·8	517	514	— 3
1893·6	511	511	0
1894·8	514	507	— 7
1896·0	0·2522	0·2502	—0·0020

Secular variations of the magnetic declination, dip and intensity—Continued.

SAN FRANCISCO, CAL.—Continued.

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	—15·01	61·95	0·2530	0·5380
1840	15·43	62·11	54	460
1850	15·80	·24	68	514
1860	16·11	·34	72	540
1870	16·36	·40	66	539
1880	16·57	·43	50	510
1890	16·64	·42	0·2523	449
1900	—16·7	62·38	0·2486	0·5362

MONTEREY, CAL.

$\varphi=36° 36'.1$ $\lambda=121° 53'.6$ W. of Gr.

[Custom-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1783·3	12 26 E.	Deduced from 122 observations by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1786, Sept. 14, 15.	11 48 E.	La Perouse.
3	1791, Sept. 23.	10 56 E.	Don A. Malaspina.
4	1792, Dec.	12 22 E.	Capt. G. Vancouver.
5	1794, Nov. 13.	12 22 E.	Capt. G. Vancouver.
	1818, Sept.	16½ E.	Capt. V. M. Golovnin. Not used.
	1827—	15 38 E.	Capt. F. W. Beechey. Not used.
6	1837—	14½ E.	Du Petit Thouars.
7	1839—	14½ E.	Sir E. Belcher.
8	1841—	15 E.	Duflot de Mofras.
9	1843—	14 E.	T. A. Dornin.
10	1851, Feb. 8.	14 58·3 E.	G. Davidson, U. S. Coast S. At Point Pinos.
11	1854, May 29, 30.	14 58·9 E.	Lieut. W. P. Trowbridge, U. S. Coast S. Near Barracks of Redoubt.
12	1873, Aug. 30, 31, Sept. 1.	15 55·3 E.	G. Davidson and S. R. Throckmorton, U. S. Coast S. Near astronomic station.
13	1881, Apr. 20.	15 53·9 E.	Lieut. H. E. Nichols, U. S. N. In redoubt.
14	1896, Jan. 14, 15.	16 14·6 E.	F. Morse, U. S. Coast & G. S.

$$D=-13°.25+2.83 \sin(1.10\,m-144°.0)$$

Date.	Obs'd D.	*p.*	Comp'd D.	C—O.	Date.	Obs'd D.	*p.*	Comp'd D.	C—O.
	°		°	°		°		°	°
1783·3	—12·44	¼	—11·53	+0·91	1841·5	—15·00		—14·52	+0·48
1786·7	11·80		11·69	+0.11	1843·5	14·00		14·61	—0·61
1791·7	10·93		11·92	—0·99	1851·1	14.97		14·96	+0·01
1792·9	12·37		11·98	+0·39	1854·4	14·98		15·10	—0·12
1794·9	12·37		12·07	+0·30	1873.7	15·92		15·75	+0·17
1837·5	14·50		14·32	+0·18	1881·3	15·90		16·04	—0·14
1839·5	—14·22		—14.42	—0·20	1896·0	—16·24		—16·08	+0·16

Secular variations of the magnetic declination, dip and intensity—Continued.

MONTEREY, CAL.—Continued.

DIP AND INTENSITY AT MONTEREY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1791, Sept. 23.	60 56·2 (?)	......	......	Don A. Malaspina.
2	1792, Dec.	63 00·5	......	......	Capt. G. Vancouver.
3	1794, Nov.	63 00	......	......	" " "
4	1818, Sept.	64 15 (?)	......	......	Capt. V. M. Golovnin. At the Presidio.
5	1831, Jan.	62 07·5	0·2595 (?)	0·5550 (?)	D. Douglass. Near landing place.
6	1839—	61 03·6 (?)	0·2612 (?)	0·5398 (?)	Sir E. Belcher. " " "
7	1843, Sept. 19.	61 58·9	......	......	T. H. Perry.
8	1854, May 19–25.	60 59·5	0·2675	0·5516	Lieut. W. P. Trowbridge, U. S. Coast S. At the barracks of redoubt.
9	1873, Sept. 1, 2.	61 12·5	0·2626	0·5452	S. R. Throckmorton, U. S. Coast S. At Point Pinos.
10	1881, Apr. 19, 20.	61 12·7	0·2611	0·5422	Lieut. H. E. Nichols, U. S. N. At the barracks.
11	1896, Jan. 14, 15.	61 15·9	0·2597	0·5402	F. Morse, U. S. Coast & G. S. Near station redoubt.

$$\Theta = 61^\circ{\cdot}55 - 0{\cdot}016\,6\ m + 0{\cdot}000\,180\ m^2$$
$$H = 0{\cdot}2640 + 0{\cdot}000\,123\ m - 0{\cdot}000\,005\,2\ m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1793·0	63·01	63·08	+0·07
1794·9	63·00	63·01	+0·01
1831·0	62.12	61·93	—0·19
1843·7	61·98	61·66	—0·32
1854·4	60·99	61·48	+0·49
1873·7	61·21	61·26	+0·05
1881·3	61·21	61·21	0·00
1896·0	61·26	61·17	—0·09

Date.	Obs'd H.	Comp'd H.	C—O.
1831·0	0·2595	0·2598	+0·0003
1839·5	0·2612	0·2621	+ 09
1854·4	0·2675	0·2644	— 31
1873·7	0·2626	0·2640	+ 14
1881·3	0·2611	0·2627	+ 16
1896·0	0·2597	0·2585	—0·0012

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	—13·93	61·95	0·2594	0·5516
1840	14·45	61·73	622	536
1850	14·91	61·55	640	542
1860	15·32	61·40	647	529
1870	15·65	61·29	644	505
1880	15·89	61.21	630	461
1890	16·04	61·17	605	402
1900	—16·1	61·17	0·2570	0·5330

SANTA BARBARA, CAL.

$\varphi = 34^\circ\ 24'{\cdot}2$ $\lambda = 119^\circ\ 43'{\cdot}0$ W. of Gr.

[Astronomic station.]

No.	Date.	D.	References and remarks.
		° ′	
1	1714·8	7½ E.	Sauvague le Muet.
2	1783·3	11 22 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
3	1793, Nov.	10 15 E.	Capt. G. Vancouver.
4	1839—	13 28 E.	Sir E. Belcher.
5	1869, Nov. 16–19,	15 11·9 E.	S. R. Throckmorton, U. S. Coast S. (G. Davidson in charge.)
6	1881, Apr. 14.	14 51·9 E.	Lieut. H. E. Nichols, U. S. N.

Secular variations of the magnetic declination, dip and intensity—Continued.

SANTA BARBARA, CAL.—Continued.

$D = -11°.52 + 3.32 \sin (1.10\,m - 123°.1)$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1714·8	— 7·50	¼	— 8·19	—0·67
1783·3	11·36		10·58	+0·78
1793·8	10·25		11·23	—0·98
1839·5	13·47	½	13·88	—0·41
1869·9	15·20	½	14·78	+0·42
1881·3	—14·87		—14·80	+0·07

DIP AND INTENSITY AT SANTA BARBARA.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1831, May.	60 48	0·2702	0·5539	D. Douglas.
2	1839—	58 54·1	0·2732	0·5289	Sir E. Belcher. At landing place.
3	1869, Nov. 20–25.	59 16·0	0·2751	0·5383	G. Davidson and S. R. Throckmorton, U. S. Coast S. On spur of hills.
4	1881, Apr. 13, 14.	59 19·2	0·2707	0·5305	Lieut. N. E. Nichols, U. S. N. West of Long Wharf.

$H = 0.2760 + 0.000\,139\,m - 0.000\,009\,7\,m^2$

Date.	Obs'd H.	Comp'd H.	C—O.
1831·4	0·2702	0·2700	—0·0002
1839·5	32	35	+ 3
1869·9	51	49	— 2
1881·3	0·2707	0·2708	+0·0001

SAN DIEGO, CAL.

$\varphi = 32°\ 39'.8$ $\lambda = 117°\ 14'.8$ W. of Gr.

[New light-house, Point Loma.]

No.	Date.	D.	References and remarks.
		° ′	
1	1714·8	6 E.	Sauvague le Muet.
2	1783·3	10 26 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
3	1792—	11 E.	Capt. G. Vancouver.
	1793—	11 E.	Capt. G. Vancouver. Not used.
4	1839—	12 20·6 E.	Sir E. Belcher.
	1841—	11 E.	Duflot de Mofras. Not used.
5	1851, Apr. 28 to May 7.	12 28·8 E.	G. Davidson, U. S. Coast S. At La Playa, Point Loma.
6	1853, Oct. 15.	12 31·7 E.	Lieut. W. P. Trowbridge, U. S. Coast S. At La Playa, near custom-house.
7	1866, June 15.	13 09·4 E.	W. Harkness, U. S. N. At La Playa.
8	1871, May 28, 29, 30.	14 46·7 E.	G. Davidson, U. S. Coast S. At New San Diego in $\varphi = 32°$ 43′·1, $\lambda = 117°$ 09′·7. Reduction to La Playa, Point Loma + 34′. [See below for 1892.]
9	1872, Nov. 19, 20, 21.	13 19·4 E.	G. Davidson and S. R. Throckmorton, U. S. Coast S. Near La Playa.
	1879—	12 55 E.	Capt. W. A. Jones. Not used.
10	1881, Jan.	13 30 E.	C. R. Gutheil, survey of the light-house reservation. Lieut. Col. Williamson, U. S. E., in charge.
10	1881, Apr. 6.	13 27·6 E.	Lieut. H. E. Nichols, U. S. N.
11	1888, June 16, 17.	13 04·2 E.	Lieut. C. F. Pond, U. S. N.
12	1892, Feb. 1–5.	13 56·4 E.	G. R. Putnam, U. S. Coast & G. S. At City Park, San Diego, $\varphi = 32°$ 43′·4, $\lambda = 117°$ 09′·7.
12	1892, Feb. 8, 9.	13 22·1 E.	G. R. Putnam, U. S. Coast & G. S. At La Playa, Point Loma, $\varphi = 32°$ 42′·2, $\lambda = 117°$ 14′·5.

Secular variations of the magnetic declination, dip and intensity—Continued.

SAN DIEGO, CAL.—Continued.

$$D = -10^\circ{\cdot}30 + 3{\cdot}04 \sin(1{\cdot}10\, m - 117^\circ{\cdot}6)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.	Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°		°		°	°
1714·8	— 6·00	¼	— 7·27	—1·27	1866·4	—13·16		—13·30	—0·14
1783·3	10·43	½	9·72	+0·71	1871·4	14·21		13·33	+0·88
1792·5	11·00	½	10·26	+0·74	1872·9	13·32		13·33	—0·01
1839·5	12·34		12·65	—0·31	1881·2	13·48		13·32	+0·16
1851·3	12·48		13·03	—0·55	1888·5	13·07		13·24	—0·17
1853·8	—12·53		—13·09	—0·56	1892·1	—13·37	1½	—13·18	+0·19

DIP AND INTENSITY AT SAN DIEGO.

No.	Date.	Θ.		H.	F.	References.
		°	′			
1	1793, Nov. and Dec.	59	13	......	......	G. Vancouver.
2	1839—	57	06·1	0·2832	0·5214	Sir E. Belcher. On tongue east side.
3	1849—	57	33	......	......	W. H. Emory, U. S. and Mex. Boundary Survey.
4	1853, Sept. and Oct.	57	38·6	0·2891	0·5402	Lieut. W. P. Trowbridge, U. S. Coast S. At La Playa.
5	1866, June 16.	57	54	0·2887	0·5433	Prof. W. Harkness, U. S. N.
6	1872, Nov. 22, 23.	57	56·8	0·2840	0·5351	S. R. Throckmorton, U. S. Coast S. At La Playa.
7	1881, Apr. 5, 6.	57	51·2	0·2814	0·5289	Lieut. H. E. Nichols, U. S. N. At La Playa.
8	1888, June 16, 17.	57	56·6	0·2932(?)	0·5524(?)	Lieut. C. F. Pond, " " " "
9	1892, Feb. 8, 9.	58	01·6	0·2785	0·5259	G. R. Putnam, U. S. Coast & G. S. At La Playa. H at City Park 0·2795.

Omitting the observations of the dip in 1793 and of the horizontal component of the force in 1888, as defective, the above observations are represented by—

$$\Theta = 57^\circ{\cdot}510 + 0{\cdot}029\,25\, m - 0{\cdot}000\,452\, m^2$$
$$H = 0{\cdot}2869 + 0{\cdot}000\,2\, m - 0{\cdot}000\,010\,3\, m^2$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1839·5	57·10	57·15	+0·05
1849·5	57·55	57·50	—0·05
1853·8	57·64	57·61	—0·03
1866·4	57·90	57·87	—0·03
1872·9	57·95	57·94	—0·01
1881·2	57·85	57·98	+0·13
1888·5	57·94	57·97	+0·03
1892·1	58·03	57·94	—0·09

Date.	Obs'd H.	Comp'd H.	C—O.
1839·5	0·2832	0·2837	+0·0005
1853·8	91	75	— 16
1866·4	87	74	— 13
1872·9	40	61	+ 21
1881·2	0·2814	0·2831	+ 17
1892·1	0·2785	0·2771	—0·0014

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.	H.	F.
	°	°		
1830	—12·27	56·74	......	......
1840	12·67	57·17	0·2839	0·5237
1850	12·99	57·51	869	341
1860	13·21	57·76	879	397
1870	13·32	57·91	868	398
1880	13·32	57·98	836	349
1890	13·2	57·96	784	248
1900	—13	57·84	0·2711	0·5093

Secular variations of the magnetic declination, dip and intensity—**Continued.**

EL PASO AND FORT BLISS, TEX.

$\varphi = 31° 45'.5$ $\lambda = 106° 29'.1$ W. of Gr.

[Fort Bliss.]

No.	Date.	D.	References and remarks.
		° ′	
1	1852—	12 24 E.	W. H. Emory. At Frontera. $\varphi = 31° 49'$, $\lambda = 106° 29'$.
2	1855, Jan.	11 55 E.	" " " " Initial point of boundary survey, $\varphi = 31° 47'$, $\lambda = 106° 28'$.
3	1859, Jan. 20.	12 25·0 E.	J. H. Clark, Commissioner. At Frontera.
4	1878—	12 25·2 E.	Report of Chief of Engineers. At Fort Bliss.
5	1884, Apr. 8.	12 05 E.	G. Davidson, U. S. Coast & G. S. North of R. R. depot, $\varphi = 31° 45'.5$, $\lambda = 106° 27'$.
6	1888, Dec. 1, 2.	11 53·8 E.	J. B. Baylor, U. S. Coast & G. S. On U. S. reservation, $\varphi = 31° 45'.5$, $\lambda = 106° 29'.3$.
7	1892, May 4, 5, 6.	11 45·6 E.	O. B. French, U. S. Coast & G. S. Station of 1888.
8	1895, Apr. 17, 18, 19.	11 46·0 E.	E. Smith, " " " " " in City Park, $\varphi = 31° 45'.5$, $\lambda = 106° 29'.2$.

$$D = -8°.50 + 3.88 \sin(1.2\, m - 110°.1)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1852·5	—12·40		—12·21	+0·19
1855·0	11·92		12·26	—0·34
1859·1	12·42		12·33	+0·09
1878·5	12·42		12·26	+0·16
1884·3	12·08		12·12	—0·04
1888·9	11·90		11·97	—0·07
1892·2	11·76		11·84	—0·08
1895·3	—11·77		—11·70	+0·07

DIP AND INTENSITY AT EL PASO AND FORT BLISS.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1852—	59 05	......	......	W. H. Emory, U. S. and Mex. Boundary Commission. At Frontera.
2	1888, Dec. 1, 2.	58 52·3	0·2802	0·5420	J. B. Baylor, U. S. Coast & G. S. At reservation.
3	1892, May 4–6.	59 00·5	0·2808	0·5454	O. B. French, U. S. Coast & G. S. At reservation.
4	1895, Apr. 16–18.	59 03·0	0·2801	0·5446	E. Smith, U. S. Coast & G. S. In City Park.

CERROS ISLAND, LOWER CALIFORNIA, MEXICO.

$\varphi = 28° 04'$ $\lambda = 115° 12'$ W. of Gr.

[Morro Rodondo Bay.]

No.	Date.	D.	References and remarks.
		° ′	
1	1714, Oct. 17.	2 E.	Sauvague le Muet. Reduction to Cerros Island + 0°·25.
2	1783·3	8 26 E.	Deduced from 112 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
3	1839—	10 46 E.	Phil. Trans. Roy. Soc. At San Bartolome Bay. Reduction to Cerros Island — 8′.
4	1873, Feb. 17, 18.	11 45·2 E.	Wm. Eimbeck, U. S. Coast S. At Cerros Island.
	1873, Sept. 9.	12 03·5 E.	Lieut. Z. L. Tanner and E. J. Young, U. S. N. At Cerros Island.
5	1874, Dec. 28.	12 09·2 E.	Lieut. J. E. Craig and C. Seymour, U. S. N. " " "
6	1881, Mar. 9.	11 58·6 E.	Lieut. H. E. Nichols, U. S. N. " " "
7	1888 Mar. 26, 29.	11 40·5 E.	Lieut. C. F. Pond, U. S. N. In Morro Rodondo Bay.
	1888 May 31, June 1.	11 38·4 E.	

Secular variations of the magnetic declination, dip and intensity—Continued.

CERROS ISLAND, LOWER CALIFORNIA, MEXICO—Continued.

$$D = -7^{\circ}.40 + 4.61 \sin (1.05\, m - 107^{\circ}.0)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1714·8	— 1·75	⅛	—3·09	—1·34
1783·3	8·43	½	7·64	+0·97
1839·5	10·90		11·47	—0·57
1873·4	11·90		11·96	—0·06
1875·0	12·15		11·94	+0·21
1881·2	11·98		11·83	+0·15
1888·3	—11·66		—11·63	+0·03

DIP AND INTENSITY AT CERROS ISLAND.

No.	Date.	Θ.	H.	F.	References.
		° ′	°	°	
1	1873, Feb. 17.	52 30·5	0·2999	0·4927	Wm. Eimbeck, U. S. Coast S.
2	1881, Mar. 7, 8.	52 55·0	0·3045	0·5050	Lieut. H. E. Nichols, U. S. N. At Cerros Island.
3	1888, Mar. 26–29.	53 03·1	0·3122	0·5194	Lieut. C. F. Pond, U. S. N. Sebastian Viscaino Bay.
	1888, Mar. 31, June 1.	52 54·7	0·3157 (?)	0·5235 (?)	Lieut. C. F. Pond, U. S. N. Morro Rodondo Bay.

ASCENSION ISLAND, LOWER CALIFORNIA, MEXICO.

$\varphi = 27^{\circ}\ 06'.3$ $\lambda = 114^{\circ}\ 18'.0$ W. of Gr.

No.	Date.	D.	References and remarks.
		° ′	
1	1783·3	7 52 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
2	1839—	10 46 E.	Sir E. Belcher. At San Bartholomew in $\varphi = 27^{\circ}\ 40'$, $\lambda = 114^{\circ}\ 53'$; Phil. Trans. Roy. Soc., 1843, p. 140. Reduction to Ascension Island about $+0^{\circ}.25$.
3	1873, Mar. 14.	11 26·4 E.	W. Eimbeck, U. S. Coast S. In $\varphi = 27^{\circ}\ 06'.4$, $\lambda = 114^{\circ}\ 18'.2$. C. & G. S. Rept. for 1881, Appendix No. 9.
	1874, Dec. 30.	12 24·8 E.	Lieuts. J. E. Craig and C. Seymour, U. S. N. Cruise of the U. S. S. Narragansett. In $\varphi = 27^{\circ}\ 06'.0$, $\lambda = 114^{\circ}\ 17'.8$. Not used.
4	1881, Mar. 5.	11 23·0 E.	Lieut. H. E. Nichols, U. S. N. At station of 1873 in $\varphi = 27^{\circ}\ 06'.0$, $\lambda = 114^{\circ}\ 18'.4$.
5	1889, Dec. 2, 3, 4.	10 58·5 E.	Lieut. C. F. Pond, U. S. N. Hydrographic Office Publication 101, Washington, 1892. In $\varphi = 27^{\circ}\ 06'.5$, $\lambda = 114^{\circ}\ 17'.7$.

$$D = -8^{\circ}.27 + 2.99 \sin (1.10\, m - 114^{\circ}.8)$$

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1783·3	— 7·87		— 7·83	+0·04
1839·5	10·52		10·67	—0·15
1873·2	11·44		11·26	+0·18
1881·2	11·38		11·22	+0·16
1889·9	—10·98	2	—11·10	—0·12

DIP AND INTENSITY AT ASCENSION ISLAND.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1881, Mar. 4, 5.	51 43·4	0·3094	0·4995	Lieut. H. E. Nichols, U. S. N.
2	1889, Dec. 2–4.	51 53·3	0·3202 (?)	0·5188 (?)	" C. F. Pond, "

Secular variations of the magnetic declination, dip and intensity—Continued.

MAGDALENA BAY, LOWER CALIFORNIA, MEXICO.

$\varphi=24° 38'.4$ $\lambda=112° 08'.9$ W. of Gr.

[Near village on Man of War Cove.]

No.	Date.	D.	References and remarks.
		° ′	
	1625, about.	4 E.	R. Dudley's Arcano del Mare. C. & G. S. Rept. for 1888, Appendix No. 6. Not used.
1	1714, Oct. 10.	1½ E.	Sauvague le Muet.
2	1783.3	6 47 E.	Deduced from 122 observations made by Spanish navigators along the coast from San Blas to Nootka. C. & G. S. Rept. for 1888, Appendix No. 7.
3	{ 1837—	8 15 E.	Du Petit Thouars.
	{ 1837—	8 17 E.	Sir E. Sabine's Contributions.
4	1839—	9 15 E.	Sir E. Belcher.
	1841—	8 15 E.	Duflot de Mofras. (See above.) Not used.
5	1866, June 9.	10 40.5 E.	Prof. W. Harkness, U. S. N.
6	1871, Mar. and June.	11 00 E.	G. Bradford, U. S. Coast S.
7	{ 1873, Mar. 5, 6, 7.	10 36.6 E.	W. Eimbeck, "
	{ 1873, June 23.	10 30.8 E.	Lieuts. Z. L. Tanner and E. J. Young, U. S. N.
8	1881, Feb. 24.	10 29.1 E.	Lieut. H. E. Nichols, U. S. N.

$D=-6°.33+4.17 \sin(1.15\, m-119°.2.$

Date.	Obs'd D. p	Comp'd D.	C—O.
	°	°	°
1714.8	− 1.50	−2.17	−0.67
1783.3	6.78	5.19	+1.59
1837.5	8.27	9.35	−1.08
1839.5	9.25	9.46	−0.21
1866.4	10.67	10.43	+0.24
1871.3	11.00	10.49	+0.51
1873.3	10.56	10.50	+0.06
1881.1	−10.48	−10.47	+0.01

DIP AND INTENSITY AT MAGDALENA BAY.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1837—	45 39	......	......	Du Petit Thouars.
2	1839—	46 34	0.3301	0.4801	Sir E. Belcher.
3	1866, June 9.	48 32	0.3309	0.4997	Prof. W. Harkness, U. S. N.
4	1873, Mar. 6, 7.	48 09.0	0.3193	0.4786	W. Eimbeck, U. S. Coast S.
5	1881, Feb. 24.	48 18.7	0.3242	0.4875	Lieut. H. E. Nichols, U. S. N.

SAN LUCAS, LOWER CALIFORNIA, MEXICO.

$\varphi=22° 53'.3$ $\lambda=109° 54'.7$ W. of Gr.

[Bay of San Lucas.]

No.	Date.	D.	References and remarks.
		° ′	
1	1709, Jan. 12.	3 E.	Capt. W. Rogers. Reduction to Cape San Lucas +30′.
2	1714, Oct. 21.	1½ E.	Sauvague le Muet.
3	1779, Nov. 15.	6 E.	San Virey and Ant. Bucareli.
	1783.3	5.85 E.	Deduced from 122 observations by Spanish navigators. C. & G. S. Rept. for 1888, Appendix No. 7. Not used.
4	1839.5	8 38 E.	Sir E. Belcher.
5	1841.5	7 53 E.	Duflot de Mofras.
6	1873, June 9.	10 23.3 E.	Lieuts. Z. L. Tanner and E. J. Young, U. S. N. Reduction to station −7′.
7	1875, Jan. 19.	9 38.8 E.	G. C. Reiter, U. S. N.
8	1881, Feb. 20.	9 26.2 E.	Lieut. H. E. Nichols, U. S. N.

Secular variations of the magnetic declination, dip and intensity—Continued.

SAN LUCAS, LOWER CALIFORNIA, MEXICO—Continued.

$D = -5^\circ{\cdot}94 + 3{\cdot}68 \sin (1{\cdot}20\, m - 116^\circ{\cdot}8)$. Approximate expression.

Date.	Obs'd D.	p.	Comp'd D.	C—O.
	°		°	°
1709·0	—2·50	½	—2·40	+0·10
1714·8	1·50	½	2·30	—0·80
1779·9	6·00	½	4·63	+1·37
1839·5	8·63		8·78	—0·15
1841·5	7·88		8·88	—1·00
1873·3	10·50		9·62	+0·88
1875·0	9·65		9·61	+0·04
1888·1	—9·44		—9.56	—0·12

DIP AND INTENSITY AT SAN LUCAS.

No.	Date.	θ.	H.	F.	References.
		° ′			
1	1839—	45 39·3	0·3347	0·4788	Sir E. Belcher.
2	1881, Feb. 19, 20.	47 23·2	0·3275	0·4837	Lieut. H. E. Nichols, U. S. N.

SAN BLAS, MEXICO.

$\varphi = 21^\circ\ 32'{\cdot}4 \qquad \lambda = 105^\circ\ 18'{\cdot}4$ W. of Gr.

[Custom-house.]

No.	Date.	D.	References and remarks.
		° ′	
1	1630, about.	2½ E.	According to the isogonic system depending on data given in Dudley's "Arcano del Mare," as developed by me in the report for 1888, Appendix No. 6.
2	1686—	4 28 E.	Dampier at Cape Corrientes, 4° 28′ E. Communicated by Asst. G. Davidson, Dec. 26, 1893. Cape Corrientes is in latitude 20° 25′ and in longitude 105° 39′ (Capt. Richards's list of geographic positions, Hydrog. Office, Washington, D. C., 1883). To reduce this observation to San Blas we make use of Van Bemmelen's isogonic chart for 1680 (neither Halley's nor Hansteen's, of 1700, are here of any assistance), and the reduction appears to be nearly 1° less at San Blas than at the cape.
3	1714, Nov. 22.	0	Sauvague le Muet. Observed at Banderas Bay, where the variation was noted 0° and referred to San Blas. Banderas Bay is between Cape Corrientes and Mita Point ($\varphi = 20^\circ\ 45'{\cdot}8$, $\lambda = 105^\circ\ 33'{\cdot}6$, according to Comdr. Dewey). Reduction to San Blas, about $+\frac{1}{4}^\circ$.
4	1788, Mar. 9.	5 E.	Don Esteban Martinez, in the Princessa. In $\varphi = 21^\circ\ 30'$, and $\lambda = 105\frac{1}{2}^\circ$ W.
5	1791, Apr. 12.	7 28 E.	Don A. Malaspina. Observed on shore.
6	1821–22.	8 40 E.	Hall.
	1828—	11 06 E.	Capt. F. W. Beechey. Not used.
7	1837—	8 34 E.	Sir Edward Belcher, on Palm Island, in $\varphi = 21^\circ\ 32'$, $\lambda = 105^\circ\ 16'$. Phil. Trans. Roy. Soc., 1843.
	1837—	9 09 E.	Du Petit Thouars. Sabine's Contributions to Terr. Mag. Phil. Trans. Roy. Soc., vol. 165, part 1, 1875.
8	1838—	8 47 E.	Sir Edw. Belcher, in the Sulphur. Phil. Trans. Roy. Soc., 1875.
9	1839—	9 00 E.	" " " on beach. " " " " 1843.
10	1841—	9 12 E.	Duflot de Mofras. Exploration of Oregon, Paris, 1844. In $\varphi = 21^\circ\ 32'{\cdot}6$, $\lambda = 105^\circ\ 15'{\cdot}8$.
11	1874, Feb. 23, 24, 26.	9 08·2 E.	Lieuts. Z. L. Tanner and E. J. Young. Cruise of the Narragansett, G. Dewey, comdr. In $\varphi = 21^\circ\ 32'{\cdot}4$, $\lambda = 105^\circ\ 18'{\cdot}7$.
	1874, Mar.	8 55 E.	Lieuts. C. Seymour and E. J. Young. At Mita Point. (In $\varphi = 20^\circ\ 46'{\cdot}1$, $\lambda = 105^\circ\ 32'{\cdot}2$). Not used.
12	1880, Dec. 5.	9 18·1 E.	Lieut. H. E. Nichols, U. S. N. Near custom-house and station of 1839.

Secular variations of the magnetic declination, dip and intensity—Continued.

SAN BLAS, MEXICO—Continued.

$D = -5°{\cdot}14 + 4{\cdot}28 \sin (1{\cdot}15\, m - 97°{\cdot}9)$

Date.	Obs'd D.	*p.*	Comp'd D.	C − O.	Date.	Obs'd D.	*p.*	Comp'd D.	C − O.
	°		°	°		°		°	°
1630·0	—2·50	¼	—4·47	—1·97	1837·5	—8·86		—9·10	—0·24
1685·0	—3·50	⅓	1 02	+2·48	1838·5	8·79		9·13	—0·34
1714·9	+0.25	½	1·04	—1·29	1839·5	9·00		9·16	—0·16
1788·2	—5·00		5·96	—0·96	1841·5	9·20		9·21	—0·01
1791·3	—7·47		6·22	+1·25	1874·1	9·14		9·17	—0·03
1822·0	8·67		—8·41	+0·26	1880·9	—9·30	1½	—8·93	+0·37

DIP AND INTENSITY AT SAN BLAS.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1791, Apr. 12.	43 11·2			Don A. Malaspina.
2	1837—	{ 46 09 45 24·3			Du Petit Thouars. Sir E. Belcher. On Palm Island.
3	1838—	44 36			"
4	1839—	44 32·5	0·3422	0·4801	" On beach.
5	1880, Dec. 4, 5.	46 20·8	0·3322	0·4812	Lieut. H. E. Nichols, U. S. N.

MEXICO CITY, MEXICO.

$\varphi = 19°\ 26'{\cdot}0 \qquad \lambda = 99°\ 06'{\cdot}6$ W. of Gr.

[Observatorio Nacional.]

No.	Date.	D.	References and remarks.
		° ′	
1	{ 1769, June. 1769, Dec.	5 20 E. 5 35 E.	} Don Alzate.
2	1775—	6 42 E.	Velasquez de Leon.
3	1803, Dec.	8 08 E.	Alex. von Humboldt.
4	1849—	8 30·2 E.	Gomez de la Cortina.
5	1850—	8 35·2 E.	Velasquez y Teran.
6	1856, Dec. 10–17.	8 46 E.	A. Sonntag.
7	1858—	8 22·3 E.	Almazan.
8	1860—	8 30 E.	Salazar Llarrequi.
9	{ 1862— 1862—	8 20·5 E. 8 34·8 E.	Diaz Covarrubias. Iglesias.
10	{ 1866— 1867—	8 08·5 E. 8 09·3 E.	} Ponce de Leon.
11	1868—	8 10·0 E.	Fernandez y Diaz Covarrubias.
12	1879, Sept., Oct., Nov., Dec.	8 34·5 E.	V. Reyes.
13	1884, Apr. 5–19.	8 19·0 E.	Sr. Barcena and G. Davidson, U. S. Coast & G. S.
14	1893, Dec.	7 41·1 E.	} Sr. Morena y Anda. Estudio sobre el magnetismo terrestre en Mexico. Mexico, 1895.
15	1894, Jan., Feb., Apr., May, Sept., Oct., Nov., and Dec.	7 43·6 E.	
16	1895, Jan. to Dec. incl.	7 45·7 E.	Sr. Manuel Morena y Anda. Boletin del observatorio astronomico Nacional de Tacubaya.

$D = -5°{\cdot}44 + 3{\cdot}28 \sin (1{\cdot}0\, m - 87°{\cdot}9)$

Date.	Obs'd D.	*p.*	Comp'd D.	C − O.	Date.	Obs'd D.	*p.*	Comp'd D.	C − O.
	°		°	°		°		°	°
1769·7	—5.46		—6·11	—0·65	1862·5	—8·46		—8·62	—0·16
1775·5	6·70		6·43	+0·27	1867·0	8·15		8·54	—0·39
1804·0	8·13		7·80	+0·33	1868·5	8·17		8·51	—0·34
1849·5	8·50		8·72	—0·22	1879·8	8·58		8·22	+0·36
1850·5	8·59		8·72	—0·13	1884·3	8·32		8·08	+0·24
1856·9	8·77		8·68	+0·09	1893·9	7·68		7·72	—0·04
1858·5	8·37		8·66	—0·29	1894·5	7·73		7·69	+0·04
1860·5	—8·50		—8·64	—0·14	1895·5	—7·76		—7·65	+0·11

Secular variations of the magnetic declination, dip and intensity—Continued.

MEXICO CITY, MEXICO—Continued.

DIP AND INTENSITY AT MEXICO.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1778—	38 00	......	......	Don Alzate.
2	1799—	42 10	......	......	Alex. von Humboldt.
3	1803, Dec.	42 10	0·3085 (?)	......	" " " Value of H a rough approximation.
4	1857, Dec. 10, 17.	41 26 (?)	0·3493	......	A. Sonntag and von Mueller.
5	1879, Sept.-Dec.	44 51·7	0·3449	0·4866	V. Reyes.
6	1884, Apr. 5-19.	45 01·4	......	......	Sr. Barcena.
7	1889, Nov. to 1890, Jan.	44 06·8	......	......	Bulletin del Observatorio Nacional at Tacubaya.
8	1893, Dec.	44 16·1	0·3347	0·4674	Sr. Morena y Anda. Observatorio Nacional.
9	1894, Jan.-May and Dec.	44 16·6	0·3347	0·4676	" "
10	1895, Jan., Feb., Mar., Apr., May, Sept.	44 21·5	0·3335	0·4664	" "

VERA CRUZ, MEXICO.

$\varphi = 19° 12'·0$ $\lambda = 96° 08'·8$ W. of Gr.

[Castle San Juan d'Alloa.]

No.	Date.	D.	References and remarks.
		° ′	
	1625, about.	3 W.	R. Dudley's "Arcano del Mare." Not used.
1	1726-27.	2 15 E.	J. Harris.
2	{ 1769—	6 40 E.	Ency. Brit.
	{ 1769, Mar. 15.	6 28 E.	Chappe.
3	1776—	7 30 E.	Don Ulloa.
	1815—	10 37 E.	Malony. Not used.
4	1819, Apr. 27.	9 16 E.	Wise.
5	1839—	8 22 E.	Behard.
6	1856, Aug. 7, 8.	8 17 E.	A. Sonntag.
7	1861—	8 20 E.	English Admiralty Chart.
8	1880, Feb. 10, 11, 12.	7 26·3 E.	Lieut. S. M. Ackley, U. S. N.
9	1888, Dec. 21-25.	7 12·7 E.	Ensign J. H. L. Halcombe and Lieut. C. Laird, U. S. N. Letter of R. Clover, hydrographer, U. S. N., dated Jan. 28, 1891. At Plaza Baluarte in $\varphi = 19° 12'·0$, $\lambda = 96° 07'·4$.

$$D = -5°·35 + 3°·71 \sin (1·15\, m - 69°·1)$$

Date.	Obs'd D. p.	Comp'd D.	C—O.
	°	°	°
1727·0	—2·25	—3·47	—1·22
1769·4	6·57	6·51	+0·06
1776·5	7·50	7·00	+0·50
1819·3	9·27	8·94	+0·33
1839·5	8·37	9·02	—0·65
1856·6	8·28	8·61	—0·33
1861·5	8·33	8·42	—0·09
1880·1	7·44	7·45	—0·01
1888·9	—7·18	—6·88	+0·30

DIP AND INTENSITY AT VERA CRUZ.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1856, Aug. 7, 8.	43 58	0·3473	0·4825	A. Sonntag and von Mueller. Villa von la Guaca.
2	1880, Feb. 10-12.	44 04·6	0·3408	0·4743	Lieut. S. M. Ackley, U. S. N. N. E. bastion Castle S. J. d'Ulloa.
3	1888, Dec. 21-25.	44 20	.....	......	Ensign Holcombe and Lieuts. Laird and Norrig, U. S. N. On Plaza Baluarte.

Secular variations of the magnetic declination, dip and intensity—Continued.

ACAPULCO, MEXICO.

$\phi = 16° 50'.5 \qquad \lambda = 99° 53'.5$ W. of Gr.

[Near Fort San Diego.]

No.	Date.	D.	References and remarks.
		° ′	
	1625, about.	1½ E.	According to R. Dudley's "Arcano del Mare." Not used.
1	1744—	3 E.	Anson.
2	1791, Apr. 29.	7 44 E.	Don A. Malaspina.
3	1822—	8 40 E.	Hall.
4	1828—	9 07 E.	Capt. F. W. Beechey.
5	1837—	8 23 E.	Sir E. Belcher.
	1838—	8 13 E.	
	1838—	8 17 E.	Du Petit Thouars.
	1841—	8 17 E.	Duflot de Mofras. Not used (same value as above).
6	1866, May 30.	8 22 E.	Prof. W. Harkness, U. S. N. In cocoanut grove.
7	1874, Mar. 17.	8 38.7 E.	Lieuts. Z. L. Tanner and E. J. Young, U. S. N.
8	1880, Nov. 23, 24.	7 56.6 E.	Lieut. H. E. Nichols, U. S. N. In cocoanut grove.
9	1882, Nov. 18.	7 54 E.	W. P. Ray, U. S. N.
10	1892, Nov. 17, 18.	7 35 E.	Lieut. Louis Mottez. Annales hydrographiques, vol. 2 of 1893. East of Fort San Diego.

$$D = -4°.48 + 4.41 \sin (1.0\, m - 85°.7)$$

Date.	Obs'd D.	*p*.	Comp'd D.	C—O.	Date.	Obs'd D.	*p*.	Comp'd D.	C—O.
	°		°	°		°		°	°
1744.5	—3.00		—3.62	—0.62	1866.5	—8.37		—8.60	—0.23
1791.3	7.73		7.05	+0.68	1874.2	8.64		8.36	+0.28
1822.5	8.67		8.53	+0.14	1880.9	7.94		8.08	—0.14
1828.5	9.12		8.69	+0.43	1882.9	7.90		7.99	—0.09
1838.0	—8.29		—8.85	—0.56	1892.9	—7.58		—7.48	+0.10

DIP AND INTENSITY AT ACAPULCO.

No.	Date.	Θ.	H.	F.	References.
		° ′			
1	1791, Apr. 29.	36 07.5	......	......	Don A. Malaspina.
2	1803, Mar.	38 53	......	......	Alex. von Humboldt.
3	1838—	37 57.4	0.3647	0.4625	Sir E. Belcher.
4	1866, May 30.	39 54	0.3569	0.4652	Prof. W. Harkness, U. S. N. In cocoanut grove.
5	1880, Nov. 22–24.	40 08.5	0.3466	0.4534	Lieut. H. E. Nichols, U. S. N. In cocoanut grove.
6	1892, Nov. 17, 18.	40 25	0.3462	0.4547	Lieut. L. Mottez. East of Fort San Diego.

$$\Theta = 39°.05 + 0.033\,9\, m$$

Date.	Obs'd Θ.	Comp'd Θ.	C—O.
	°	°	°
1791.3	36.12	37.06	+0.94
1803.2	38.88	37.46	—1.42
1838.5	37.96	38.66	+0.70
1866.4	39.90	39.61	—0.29
1880.9	40.14	40.10	—0.04
1892.9	40.42	40.50	+0.08

COMPUTED DECENNIAL VALUES.

Date.	D.	Θ.
	°	°
1790	—7.0	37.02
1800	7.6	37.36
1810	8.1	37.69
1820	8.5	38.03
1830	8.7	38.37
1840	8.9	38.71
1850	8.88	39.05
1860	8.75	39.39
1870	8.50	39.73
1880	8.12	40.07
1890	7.64	40.41
1900	—7.1	40.75

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION.

Recapitulation of expressions for the secular variation of the declination.

GROUP I.

No.	Locality.	Latitude.		Longitude.		Expression for secular variation of the declination.* (m = year − 1850·0.)
		°	′	°	′	° ° °
1	St. John's, Newfoundland.	47	34·4	52	41·9	$D=+22{\cdot}16+8{\cdot}71\sin(1{\cdot}1\,m+70{\cdot}4)$
2	Quebec, Canada.	46	48·4	71	14·5	$14{\cdot}66+3{\cdot}03\sin(1{\cdot}4\,m+4{\cdot}6)+0{\cdot}61\sin(4\,m+0{\cdot}3)$
3	Charlottetown, Prince Edward Island.	46	14	63	27	$15{\cdot}50+7{\cdot}72\sin(1{\cdot}05\,m+58{\cdot}6)$ †
4	Montreal, Canada.	45	30·5	73	34·6	$11{\cdot}87+4{\cdot}33\sin(1{\cdot}45\,m-18{\cdot}8)$
5	Eastport, Me.	44	54·4	66	59·2	$15{\cdot}18+3{\cdot}79\sin(1{\cdot}25\,m+31{\cdot}1)$
6	Bangor, Me.	44	48·2	68	46·9	$13{\cdot}60+3{\cdot}60\sin(1{\cdot}30\,m+14{\cdot}1)$
7	Halifax, Nova Scotia.	44	39·6	63	35·3	$16{\cdot}18+4{\cdot}53\sin(1{\cdot}0\,m+46{\cdot}1)$
8	Burlington, Vt.	44	28·7	73	12·0	$9{\cdot}99+2{\cdot}87\sin(1{\cdot}4\,m-8{\cdot}3)$
9	Hanover, N. H.	43	42·3	72	17·1	$9{\cdot}38+3{\cdot}75\sin(1{\cdot}4\,m-5{\cdot}9)$
10	Portland, Me.	43	38.8	70	16·6	$11{\cdot}40+3{\cdot}28\sin(1{\cdot}30\,m+2{\cdot}7)$
11	Rutland, Vt.	43	36·2	72	55·0	$9{\cdot}80+3{\cdot}44\sin(1{\cdot}42\,m-21{\cdot}3)$
12	Portsmouth, N. H.	43	04·3	70	42·5	$10{\cdot}55+3{\cdot}08\sin(1{\cdot}4\,m-5{\cdot}1)$
13	Chesterfield, N. H.	42	53·5	72	24	$8{\cdot}67+3{\cdot}22\sin(1{\cdot}45\,m-1{\cdot}9)+0{\cdot}21\sin(9\,m+168)$
14	Newburyport, Mass.	42	48·9	70	49·2	$10{\cdot}07+3{\cdot}02\sin(1{\cdot}35\,m-1{\cdot}0)$
15	Williamstown, Mass.	42	42·8	73	13·4	$8{\cdot}84+3{\cdot}13\sin(1{\cdot}4\,m-14{\cdot}0)$
16	Albany, N. Y.	42	39·2	73	45·8	$8{\cdot}76+3{\cdot}33\sin(1{\cdot}25\,m-18{\cdot}0)$
17	Salem, Mass.	42	31·9	70	52·5	$9{\cdot}98+3{\cdot}85\sin(1{\cdot}4\,m-5{\cdot}1)$
18	Oxford, N. Y.	42	26·5	75	40·5	$6{\cdot}19+3{\cdot}24\sin(1{\cdot}35\,m-18{\cdot}9)$
19	Cambridge, Mass.	42	22·9	71	07·7	$9{\cdot}68+2{\cdot}81\sin(1{\cdot}32\,m+5{\cdot}9)$
20	Boston, Mass.	42	21·5	71	03·9	$9{\cdot}58+2{\cdot}90\sin(1{\cdot}32\,m+5{\cdot}0)$
21	Provincetown, Mass.	42	03·1	70	11·3	$9{\cdot}76+3{\cdot}20\sin(1{\cdot}30\,m+10{\cdot}7)$
22	Providence, R. I.	41	50·2	71	23·8	$9{\cdot}09+3{\cdot}00\sin(1{\cdot}40\,m-2{\cdot}8)+0{\cdot}15\sin(6\,m+117)$
23	Hartford, Conn.	41	45·9	72	40·4	$8{\cdot}06+2{\cdot}98\sin(1{\cdot}35\,m-16{\cdot}1)$
24	New Haven, Conn.	41	18·5	72	55·7	$7{\cdot}72+3{\cdot}03\sin(1{\cdot}35\,m-21{\cdot}9)$
25	Nantucket, Mass.	41	17·0	70	06·0	$9{\cdot}21+3{\cdot}03\sin(1{\cdot}23\,m+6{\cdot}9)$
26	Cold Spring Harbor, N. Y.	40	52·5	73	28	$7{\cdot}19+2{\cdot}52\sin(1{\cdot}35\,m-11{\cdot}4)$
27	New York City, N. Y.	40	42·7	74	00·4	$7{\cdot}04+2{\cdot}77\sin(1{\cdot}30\,m-18{\cdot}1)+0{\cdot}14\sin(6{\cdot}3\,m+64)$
28	South Bethlehem, Pa.	40	36·4	75	22·9	$5{\cdot}27+3{\cdot}05\sin(1{\cdot}46\,m-34{\cdot}8)$
29	Huntingdon, Pa.	40	31	78	02	$3{\cdot}76+2{\cdot}93\sin(1{\cdot}48\,m-35{\cdot}2)$
30	New Brunswick, N. J.	40	29·9	74	26·8	$5{\cdot}11+2{\cdot}94\sin(1{\cdot}30\,m+4{\cdot}2)$
31	Jamesburg, N. J.	40	21	74	27	$6{\cdot}03+2{\cdot}94\sin(1{\cdot}40\,m-22{\cdot}4)$
32	Harrisburg, Pa.	40	15·9	76	52·9	$3{\cdot}12+2{\cdot}98\sin(1{\cdot}55\,m-4{\cdot}2)$
33	Hatboro, Pa.	40	12	75	07	$5{\cdot}17+3{\cdot}16\sin(1{\cdot}54\,m-16{\cdot}7)+0{\cdot}22\sin(4{\cdot}1\,m+157)$
34	Philadelphia, Pa.	39	56·9	75	09·0	$5{\cdot}36+3{\cdot}17\sin(1{\cdot}50\,m-26{\cdot}1)+0{\cdot}19\sin(4{\cdot}0\,m+146)$
35	Chambersburg, Pa.	39	56	77	39	$2{\cdot}79+3{\cdot}10\sin(1{\cdot}55\,m-30{\cdot}6)+0{\cdot}20\sin(4{\cdot}6\,m+124)$
36	West Creek, Little Egg Harbor, N. J.	39	38	74	19	$5{\cdot}50+2{\cdot}78\sin(1{\cdot}5\,m-18{\cdot}4)$
37	Baltimore, Md.	39	17·8	76	37·0	$3{\cdot}38+2{\cdot}72\sin(1{\cdot}4\,m-22{\cdot}3)$
38	Cape May, N. J.	38	56·0	74	57·6	$4{\cdot}31+2{\cdot}40\sin(1{\cdot}4\,m-26{\cdot}7)$
39	Washington, D. C.	38	53·3	77	00·6	$2{\cdot}53+2{\cdot}64\sin(1{\cdot}45\,m-16{\cdot}6)$
40	Cape Henlopen, Del.	38	46·7	75	05·0	$4{\cdot}01+3{\cdot}22\sin(1{\cdot}35\,m-25{\cdot}2)$
41	Williamsburg, Va.	37	16·2	76	42·4	$2{\cdot}20+2{\cdot}48\sin(1{\cdot}5\,m-32{\cdot}2)$
42	Cape Henry, Va.	36	55·6	76	00·4	$2{\cdot}42+2{\cdot}25\sin(1{\cdot}47\,m-30{\cdot}6)$
43	Newbern, N. C.	35	06	77	02	$+\ 0{\cdot}41+2{\cdot}53\sin(1{\cdot}45\,m-11{\cdot}6)$
44	Milledgeville, Ga.	33	04·2	83	12	$-\ 3{\cdot}10+2{\cdot}53\sin(1{\cdot}4\,\mathrm{m}-61{\cdot}9)$
45	Charleston, S. C.	32	46·6	79	55·8	$-\ 1{\cdot}82+2{\cdot}75\sin(1{\cdot}40\,m-12{\cdot}1)$
46	Savannah, Ga.	32	04·9	81	05·5	$-\ 1{\cdot}94+2{\cdot}75\sin(1{\cdot}35\,m-42{\cdot}0)$
47	Fernandina, Fla.	30	40·3	81	27·7	$-\ 3{\cdot}18+0{\cdot}065\,(t-1870{\cdot}2)$

*A + sign indicates west declination, a — sign east declination. † Very uncertain.

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Recapitulation of expressions for the secular variation of the declination—Continued.

GROUP II.

No.	Locality.	Latitude.		Longitude.		Expression for secular variation of the declination.* (m = year − 1850.0.)
		°	′	°	′	° ° °
1	York Factory, Brit. North Am.	56	59.9	92	26	$D = +\ 7.34 + 16.03 \sin (1.10\,m - 97.9)$
2	Fort Albany, Brit. North Am.	52	22	82	38	$+ 15.78 + 6.95 \sin (1.20\,m - 99.6)$
3	Duluth, Minn.	46	45.5	92	04.5	$-\ 7.70 + 2.41 \sin (1.4\,m - 120)$
4	Sault de Ste. Marie, Mich.	46	29.9	84	20.1	$+\ 1.54 + 2.70 \sin (1.45\,m - 58.5)$
5	Pierrepont Manor, N. Y.	43	44.5	76	03.0	$+\ 5.95 + 3.78 \sin (1.4\,m - 22.2)$
6	Toronto, Canada.	43	39.4	79	23.3	$+\ 3.60 + 2.82 \sin (1.4\,m - 44.7) + 0.09 \sin (9.3\,m + 136) + 0.08 \sin (19\,m + 247)$
7	Grand Haven, Mich.	43	05.2	86	12.6	$-\ 4.95 + 0.038\,0\,m + 0.001\,15\,m^2$
8	Milwaukee, Wis.	43	02.5	87	54.2	$-\ 4.12 + 3.60 \sin (1.45\,m - 64.5)$
9	Buffalo, N. Y.	42	52.8	78	53.5	$+\ 3.66 + 3.47 \sin (1.4\,m - 27.8)$
10	Ithaca, N. Y.	42	26.8	76	28.9	$+\ 6.48 + 3.74 \sin (1.35\,m - 52.4)$
11	Dunkirk, N. Y.	42	29.6	79	21.3	$+\ 2.34 + 2.89 \sin (1.40\,m - 19.8)$
12	Detroit, Mich.	42	20.0	83	03.0	$-\ 0.72 + 2.42 \sin (1.40\,m - 19.0)$
13	Kalamazoo, Mich.	42	17.4	85	35.2	$-\ 1.63 + 4.21 \sin (1.40\,m - 61.6)$
14	Ypsilanti, Mich.	42	14.3	83	37	$-\ 0.76 + 3.59 \sin (1.35\,m - 11.8)$
15	Erie, Pa.	42	07.8	80	05.4	$+\ 2.17 + 2.69 \sin (1.5\,m - 27.3)$
16	Chicago, Ill.	41	50.0	87	36.8	$-\ 3.40 + 2.89 \sin (1.45\,m - 66.2)$
17	Michigan City, Ind.	41	43.4	86	54.4	$-\ 2.38 + 3.12 \sin (1.4\,m - 59.9)$
18	Cleveland, Ohio.	41	30.4	81	41.5	$+\ 0.77 + 2.53 \sin (1.30\,m - 21.6)$
19	Omaha, Nebr.	41	15.7	95	56.5	$-\ 9.61 + 3.03 \sin (1.30\,m - 50.9)$
20	Beaver, Pa.	40	44	80	20	$+\ 1.41 + 2.72 \sin (1.40\,m - 39.6)$
21	Pittsburg, Pa.	40	27.6	80	00.8	$+\ 1.85 + 2.45 \sin (1.45\,m - 28.4)$
22	Denver, Colo.	39	45.3	104	59.5	$- 15.30 + 0.011\,m + 0.000\,5\,m^2$
23	Marietta, Ohio.	39	25	81	28	$+\ 0.02 + 2.89 \sin (1.4\,m - 40.5)$
24	Athens, Ohio.	39	19	82	02	$-\ 1.51 + 2.63 \sin (1.4\,m - 24.7)$
25	Cincinnati, Ohio.	39	08.4	84	25.3	$-\ 2.59 + 2.43 \sin (1.42\,m - 37.9)$
26	St. Louis, Mo.	38	38.0	90	12.2	$-\ 5.91 + 3.00 \sin (1.40\,m - 51.1)$
27	Nashville, Tenn.	36	08.9	86	48.2	$-\ 3.57 + 3.33 \sin (1.35\,m - 68.5)$
28	Florence, Ala.	34	47.2	87	41.7	$-\ 4.25 + 2.33 \sin (1.3\,m - 52.8)$
29	Mobile, Ala.	30	41.4	88	02.5	$-\ 4.15 + 2.95 \sin (1.42\,m - 74.5)$
30	Pensacola, Fla.	30	20.8	87	18.3	$-\ 4.58 + 2.92 \sin (1.4\,m - 61.4)$
31	Austin, Tex.	30	16.4	97	44.2	$-\ 9.13 + 0.046\,6\,(t - 1873.0)$
32	New Orleans, La.	29	57.2	90	03.9	$-\ 5.20 + 2.98 \sin (1.40\,m - 69.8)$
33	San Antonio and Hill Side Range, Tex.	29	26.8 / 29.3	98	27.9 / 32.1	$-\ 7.40 + 2.92 \sin (1.35\,m - 84.8)$
34	Galveston, Tex.	29	18.2	94	47.5	$-\ 8.33 + 0.040\,9\,(t - 1876.1) + 0.000\,732\,(t - 1876.1)^2$
35	Key West, Fla.	24	33.5	81	48.5	$-\ 4.31 + 2.86 \sin (1.30\,m - 23.9)$
36	Habana, Cuba.	23	09.3	82	21.5	$-\ 3.72 + 2.79 \sin (1.05\,m - 36.7)$
37	Kingston, Jamaica.	17	55.9	76	50.6	$-\ 3.81 + 2.39 \sin (1.10\,m - 10.6)$
38	Bridgetown, Barbados.	13	05.7	59	37.3	$-\ 1.88 + 2.83 \sin (0.95\,m + 24.6)$
39	Panama, New Granada.	8	57.1	79	32.2	$-\ 5.66 + 2.22 \sin (1.10\,m - 27.8)$

* A + sign indicates west declination, a − sign east declination.

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Recapitulation of expressions for the secular variation of the declination—Continued.

GROUP III.

No.	Locality.	Latitude.	Longitude.	Expression for secular variation of the declination.* (m = year — 1850.0.)
		° ′	° ′	° ° °
1	Chamisso Id., Alaska.	66 13	161 49	$D = -29.88 + 4.35 \sin (1.2\, m + 2.6)$†
2	Port Clarence, Alaska.	65 16	166 50	$-26.09 + 4.41 \sin (1.2\, m + 4.6)$†
3	Port Etches, Constantine Hbr., Alaska.	60 20.7	146 37.6	$-22.40 + 9.13 \sin (1.2\, m - 83.6)$†
4	Port Mulgrave, Yakutat Bay, Alaska.	59 33.8	139 47.3	$-24.02 + 7.48 \sin (1.1\, m - 95.0)$†
5	St. Paul, Kadiac Id., Alaska.	57 48.0	152 21.3	$-22.21 + 5.18 \sin (1.35\, m - 72.5)$†
6	Sitka, Alaska.	57 02.9	135 20.4	$-25.48 + 3.84 \sin (1.0\, m - 116.1) + 0.32 \sin (6.5\, m + 321)$†
7	Iliuliuk, Unalaska Id., Alaska.	53 52.6	166 31.5	$-17.65 + 2.26 \sin (1.3\, m - 69.0)$
8	Petropavlovsk, Kamchatka.	53 01	201 17	$-\ 3.43 + 5.10 \sin (0.85\, m + 11.5)$†
9	Nootka, Vancouver Id.	49 35.5	126 37.5	$-21.25 + 2.74 \sin (1.30\, \mathrm{m} - 152.0)$
10	Cape Flattery and Neah Bay, Wash.	48 23.5	124 44.1	$-19.88 + 3.38 \sin (1.10\, m - 149.4)$
11	Port Townsend, Wash.	48 07.1	122 45.3	$-18.80 + 3.85 \sin (1.0 - 140.9)$
12	Seattle, Wash.	47 36.6	122 20.1	$-19.25 + 3.24 \sin (0.9\, m - 131.3)$
13	Olympia, Wash.	47 02	122 54	$-18.87 + 3.66 \sin (1.0\, m - 151.0)$
14	Cape Disappointment, Wash.	46 16.7	124 02.8	$-19.39 + 2.54 \sin (1.25\, m - 158.7)$
15	Wallawalla, Wash.	46 03.9	118 20.8	$-17.07 + 4.25 \sin (1.3\, m - 131.5)$†
16	Vancouver, Wash.	45 37.5	122 39.7	$-17.50 + 3.96 \sin (1.20\, u - 141.3)$
17	Portland, Oreg.	45 31.1	122 40.8	$-19.05 + 3.41 \sin (1.3\, m - 159.1)$†
18	Salt Lake City, Utah.	40 46.1	111 53.8	$-12.50 + 4.11 \sin (1.3\, m - 126.4)$†
19	Cape Mendocino, Cal.	40 26.3	124 24.3	$-15.25 + 2.45 \sin (1.10\, m - 128.0)$†
20	San Francisco, Cal.	37 47.5	122 27.3	$-13.73 + 2.94 \sin (0.95\, m - 135.3) + 0.056 \sin (20\, m + 87)$
21	Monterey, Cal.	36 36.1	121 53.6	$-13.25 + 2.83 \sin (1.1\, m - 144.0)$
22	Santa Barbara, Cal.	34 24.2	119 43.0	$-11.52 + 3.32 \sin (1.10\, m - 123.1)$
23	San Diego, Cal.	32 39.8	117 14.8	$-10.30 + 3.04 \sin (1.10\, m - 117.6)$
24	El Paso and Fort Bliss, Tex.	31 45.5	106 29.1	$-\ 8.50 + 3.88 \sin (1.2\, m - 110.1)$
25	Cerros Id., Low. Cal., Mex.	28 04	115 12	$-\ 7.40 + 4.61 \sin (1.05\, m - 107.0)$
26	Ascension Id., Low. Cal., Mex.	27 06.3	114 18.0	$-\ 8.27 + 2.99 \sin (1.10\, m - 114.8)$
27	Magdalena Bay, Low. Cal., Mex.	24 38.4	112 08.9	$-\ 6.33 + 4.17 \sin (1.15\, m - 119.2)$
28	San Lucas, Low. Cal., Mex.	22 53.3	109 54.7	$-\ 5.94 + 3.68 \sin (1.20\, m - 116.8)$
26	San Blas, Mex.	21 32.4	105 18.4	$-\ 5.14 + 4.28 \sin (1.15\, m - 97.9)$
30	Mexico City, Tacubaya Obs'y.	19 26.0	99 06.6	$-\ 5.44 + 3.28 \sin (1.0\, m - 87.9)$
31	Vera Cruz, Mex.	19 12.0	96 08.8	$-\ 5.35 + 3.71 \sin (1.15\, m - 69.1)$
32	Acapulco, Mex.	16 50.5	99 53.5	$-\ 4.48 + 4.41 \sin (1.0\, m - 85.7)$

*A + sign indicates west declination, a — sign east declination.

†A rough and doubtful expression. At Sitka and Yakutat a secondary maximum is apparently in process of development; at Sitka the last periodic term applies only since 1830.

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Summary of special results.

GROUP I.—DECLINATIONS.

No.	Locality.	Year of first observation.	Number of observations.	Probable error of an observation.	Approximate epoch of last magnetic eastern elongation.	Approximate declination at late eastern elongation.	Approximate epoch of nearest or prospective western elongation.	Approximate declination at late or prospective western elongation.	Annual change in 1895.	Annual change in 1900.
				′		°		°	′	′
1	St. John's, Newfoundland.	1665(?)	13	±44	1704	+13·4	1868	+30·9	−5·0	−5·8
2	Quebec, Canada.	1642	41	21	1806	+12·1	1909 (?)	+17·2	−0·5(?)	−1·0(?)
3	Charlottetown, Pr. Edw. Isd.	1833(?)	17	18	1708	+ 7·8	1880	+23·2	−2·3	−3·1
4	Montreal, Canada.	1700(?)	11	31	1801	+ 7·5	....	......	+4·5	+3·9
5	Eastport, Me.	1604–12	16	20	1753	+11·4	1897	+19·0	+0·2	−0·3
6	Bangor, Me.	1805	8	15	1770	+10·0	1908	+17·2	+1·5	+0·9
7	Halifax, Nova Scotia.	1604–12	17	31	1714	+11·6	1894 (?)	+20·7	−0·1	−0·5
8	Burlington, Vt.	1793	15	16	1792	+ 7·1	1920 (?)	+12·9	+2·4	+2·0
9	Hanover, N. H.	1765	8	52	1790	+ 5·6	....	......	+3·0	+2·4
10	Portland, Me.	1700(?)	15	10	1779	+ 8·1	1917 (?)	+14·7	+2·2	+1·7
11	Rutland, Vt.	1789	7	24	1802	+ 6·4	1928 (?)	+13·2	+3·8	+3·3
12	Portsmouth, N. H.	1771	8	11	1789	+ 7·5	....	......	+2·5	+2·0
13	Chesterfield, N. H.	1812	15	13	1784	+ 5·3	....	......	+0·7	+0·5
14	Newburyport, Mass.	1750(?)	7	13	1784	+ 7·0	1918 (?)	+13·1	+2·1	+1·7
15	Williamstown, Mass.	1750(?)	6	31	1796	+ 5·7	....	......	+3·0	+2·6
16	Albany, N. Y.	1580(?)	41	18	1792	+ 5·4	1936 (?)	+12·1	+3·4	+3·1
17	Salem, Mass.	1750(?)	10	25	1789	+ 6·1	....	......	+3·0	+2·4
18	Oxford, N. Y.	1794	14	9	1797	+ 3·0	....	......	+3·4	+3·0
19	Cambridge, Mass.	1708	26	12	1777	+ 6·9	1914	+12·5	+1·6	+1·2
20	Boston, Mass.	1700	15	23	1779	+ 6·6	1915	+12·4	+1·8	+1·4
21	Provincetown, Mass.	1620(?)	9	18	1773	+ 6·6	1911	+13·0	+1·6	+1·1
22	Providence, R. I.	1717	13	10	1778 (?)	+ 6·1	....	......	+3·0	+2·0
23	Hartford, Conn.	1713	14	9	1795	+ 5·1	1929 (?)	+11·0	+3·0	+2·7
24	New Haven, Conn.	1750(?)	20	11	1800	+ 4·7	1933	+10·8	+3·3	+3·0
25	Nantucket, Mass.	1700(?)	14	15	1771	+ 6·2	1918	+12·2	+1·8	+1·4
26	Cold Spring Harbor, N. Y.	1750(?)	14	8	1792	+ 4·7	1925 (?)	+ 9·7	+2·3	+2·0
27	New York City, N. Y.	1609	29	18	1784	+ 4·4	....	......	+3·8	+3·4
28	South Bethlehem, Pa.	1742	16	11	1812	+ 2·2	....	......	+4·0	+3·7
29	Huntingdon, Pa.	1750(?)	14	7	1813	+ 0·8	....	......	+3·9	+3·5
30	New Brunswick, N. J.	1800	19	11	1778 (?)	+ 2·2	....	......	+1·8	+1·4
31	Jamesburg, N. J.	1761	7	10	1802	+ 3·1	....	......	+3·3	+2·9
32	Harrisburg, Pa.	1795	15	15	1795	+ 0·1	....	......	+2·0	+1·4
33	Hatboro, Pa.	1680(?)	18(?)	6	1797	+ 1·8	....	......	+3·3	+3·3
34	Philadelphia, Pa.	1701	18	17	1802	+ 2·1	....	......	+4·4	+2·8(?)
35	Chambersburg, Pa.	1736	45	7	1809	− 0·5	....	......	+4·8	+4·5
36	West Creek, Little Egg Harbor, N. Y.	1687	6	22	1802	+ 2·7	....	......	+2·9	+2·4
37	Baltimore, Md.	1640(?)	20	17	1802	+ 0·7	....	......	+3·0	+2·7
38	Cape May, N. J.	1700(?)	12	6	1805	+ 1·9	....	......	+2·8	+2·6
39	Washington, D. C.	1791	40	6	1799	− 0·1	....	......	+2·7	+2·3
40	Cape Henlopen, Del.	1700(?)	8	19	1802	+ 0·8	....	......	+3·7	+3·4
41	Williamsburg Va.	1694	7	16	1811	− 0·3	....	......	+3·2	+2·9
42	Cape Henry, Va.	1700(?)	14	20	1810	+ 0·2	....	......	+2·8	+2·5
43	Newbern, N. C.	1750(?)	9	20	1796	− 2·1	....	......	+2·3	+1·9
44	Milledgeville, Ga.	1750(?)	6	18	1830 (?)	− 5·6	....	......	+3·7	+3·7
45	Charleston, S. C.	1700	16	28	1794	− 4·6	....	......	+2·5	+2·1
46	Savannah, Ga.	1750(?)	10	±23	1814	− 4·7	....	......	+3·7	+3·5
47	Fernandina, Fla.	1849	5	....	....	......	....	......	+3·9	....

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Summary of special results—Continued.

GROUP II.—DECLINATIONS.

No.	Locality.	Year of first observation.	Number of observations.	Probable error of an observation.	Approximate epoch of last magnetic eastern elongation.	Approximate declination at late eastern elongation.	Annual change in 1895.	1900.
				′		°	′	′
1	York Factory, Brit. North Am.	1725	7	±49	1857	− 8.7	+12.2	+13.5
2	Fort Albany, Brit. North Am.	1668	5	78	1858	+ 8.8	+ 6.1	+ 6.7
3	Duluth, Minn.	1859	5	28	1871 (?)	−10.1	+ 1.9	+ 2.3
4	Sault de Ste. Marie, Mich.	1790	10	12	1828	− 1.2	+ 4.1	+ 4.0
5	Pierrepont Manor, N. Y.	1823	13	7	1802	+ 2.2	+ 4.2	+ 3.7
6	Toronto, Canada.	1840	40	2	....	......	+ 4.4	+ 3.7
7	Grand Haven, Mich.	1825	8	10	1834	− 5.2	......	......
8	Milwaukee, Wis.	1859	5	29	1832	− 7.7	+ 5.5	+ 5.4
9	Buffalo, N. Y.	1797	10	10	1806	+ 0.2	+ 4.2	+ 3.8
10	Ithaca, N. Y.	1672	6	8	1822	+ 2.7	+ 5.2	+ 5.1
11	Dunkirk, N. Y.	1798	7	4	1800	− 0.6	+ 3.1	+ 2.7
12	Detroit, Mich.	1810	13	12	1799	− 3.1	+ 2.5	+ 2.2
13	Kalamazoo, Mich.	1826	8	9	1830	− 5.8	+ 6.2	+ 6.1
14	Ypsilanti, Mich.	1815	18	7	1792	− 4.4	+ 3.3	+ 2.9
15	Erie, Pa.	1786	14	13	1808	− 0.5	+ 3.2	+ 2.8
16	Chicago, Ill.	1823	5	8	1833	− 6.3	+ 4.4	+ 4.4
17	Michigan City, Ind.	1830	6	37	1828	− 5.5	+ 4.6	+ 4.5
18	Cleveland, Ohio.	1796	16	13	1797	− 1.8	+ 2.8	+ 2.6
19	Omaha, Nebr.	1819	8	9	1820	−12.6	+ 4.1	+ 4.0
20	Beaver, Pa.	1786	5	5	1814	− 1.3	+ 3.7	+ 3.6
21	Pittsburg, Pa.	1840	6	6	1808	− 0.6	+ 3.0	+ 2.7
22	Denver, Colo.	1866	5	4	1839	−15.4	+ 3.4	+ 3.7
23	Marietta, Ohio.	1810	7	23	1815	− 2.9	+ 3.9	+ 3.7
24	Athens, Ohio.	1796	6	5	1803	− 4.1	+ 3.0	+ 2.7
25	Cincinnati, Ohio.	1806	7	9	1813	− 5.0	+ 3.3	+ 3.2
26	St. Louis, Mo.	1835	7	9	1822	− 8.9	+ 4.3	+ 4.1
27	Nashville, Tenn.	1829	4	5	1834	− 6.9	+ 4.7	+ 4.7
28	Florence, Ala.	1818	6	7	1821	− 6.6	+ 3.2	+ 3.1
29	Mobile, Ala.	1814	8	6	1839	− 7.1	+ 4.3	+ 4.4
30	Pensacola, Fla.	1763	11	35	1830	− 7.5	+ 4.3	+ 4.3
31	Austin, Tex.	1835	7	....	....	......	+ 2.8	......
32	New Orleans, La.	1700(?)	12	22	1836	− 8.2	+ 4.3	+ 4.3
33	San Antonio and Hill Side, Tex.	1825	10	14	1846	−10.3	+ 3.8	+ 3.9
34	Galveston, Tex.	1848	5	....	....	......	+ 4.0	......
35	Key West, Fla.	1750(?)	14	5	1799	− 7.2	+ 3.2	+ 2.9
36	Habana, Cuba.	1726	16	18	1798	− 6.5	+ 3.0	+ 3.0
37	Kingston, Jamaica.	1726	15	25	1778	− 6.2	+ 2.1	+ 2.0
38	Bridgetown, Barbados.	1700(?)	9	33	1729 (?)	− 4.7	+ 1.1	+ 0.9
39	Panama, New Granada.	1775	12	±11	1793 (?)	− 7.9	+ 2.4	+ 2.3

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Summary of special results—Continued.

GROUP III.—DECLINATIONS.

No.	Locality.	Year of first observation.	Number of observations.	Probable error of an observation.	Approximate epoch of last magnetic eastern elongation.	Approximate declination at last eastern elongation.	Approximate epoch of next eastern elongation.	Approximate declination at next eastern elongation.	Annual change in 1895.	Annual change in 1900.
				′		°		°	′	′
1	Chamisso Island, Alaska.	1728(?)	4	±(?)	1773 (?)	−34	....	......	+6·9	.....
2	Port Clarence, Alaska.	1728(?)	6	40	1771 (?)	−30	....	......	+5(?)	(*)
3	Port Etches, Constantine Hbr., Alaska.	1778	10	40	1845 (?)	−31·5	....	......	+3(?)	(†)
4	Port Mulgrave, Yakutat Bay, Alaska.	1778	10	32	....	......	....	......	0(?)	.....
5	St. Paul, Kadiak Island, Alaska.	1778	11	31	1837	−27·4	....	......	+4(?)	(‡)
6	Sitka, Alaska.	1779	38	22	....	......	....	......	−2(?)	.....
7	Iliuliuk, Unalaska Isd., Alaska.	1790	15	15	1834	−19·9	....	......	+3·0	+3·1
8	Petropavlovsk, Kamchatka.	1728(?)	12	37	1731 (?)	− 8·5	....	......	+2·9	+2·7
9	Nootka, Vancouver Isd.	1778	7	35	....	......	1898	−24·0	−0·2	0·0
10	Cape Flattery and Neah Bay, Wash.	1783(?)	8	23	....	......	1904	−23·3	−0·7	−0·3
11	Port Townsend, Wash.	1783(?)	9	16	....	......	1901	−22·7	−0·4	−0·1
12	Seattle, Wash.	1783(?)	8	18	....	......	1896	−22·5	0·0	+0·2
13	Olympia, Wash.	1783(?)	5	31	....	......	1904	−22·4	−1·0	−0·7
14	Cape Disappointment, Wash.	1783(?)	10	23	....	......	1905	−21·9	−1·1	−0·7
15	Wallawalla, Wash.	1853	5	17	1882 (?)	−21·3	....	......	+1·7	.....
16	Vancouver, Wash.	1788	6	36	1893 (?)	−21·5	....	......	+0·2	+0·7
17	Portland, Oreg.	1783(?)	9	28	....	......	1903	−22·5	−0·9	−0·3
18	Salt Lake City, Utah.	1850	12	10	1878	−16·6	....	......	+2·1	+2·7
19	Cape Mendocino, Cal.	1783(?)	6	37	1886 (?)	−17.7	....	......	+0·6	.....
20	San Francisco, Cal.	1783(?)	33	10	....	......	1898	−16·7	−0·1	+0·1
21	Monterey, Cal.	1783(?)	13	19	....	......	1899	−16·1	−0·3	0·0
22	Santa Barbara, Cal.	1714	6	24	1880	−14·5	....	......	+1·1	+1·5
23	San Diego, Cal.	1714	12	23	1875	−13·3	....	......	+1·3	+1·6
24	El Paso, Tex.	1852	8	10	1867	−12·4	....	......	+2·7	+3·1
25	Cerros Island, Low. C., Mex.	1714	7	20	1866	−12·0	....	......	+2·5	+2·9
26	Ascension Isd., Low. C., Mex.	1783	5	13	1872	−11·3	....	......	+1·4	+1·7
27	Magdalena Bay, Low. C., Mex.	1714	8	31	1875	−10·5	....	......	+1·9	+2·2
28	San Lucas, Low. C., Mex.	1709	8	32	1872	− 9·6	....	......	+2·1	+2·5
29	San Blas, Mexico.	1630(?)	12	37	1857	− 9·4	....	......	+3·6	+3·9
30	Mexico City, Mexico.	1769	15	13	1848	− 8·6	....	......	+2·5	+2·7
31	Vera Cruz, Mexico.	1727	9	22	1832	− 9·1	....	......	+4·3	+4·4
32	Acapulco, Mexico.	1744	10	±20	1846	− 8·9	....	......	+3·5	+3·8

* The formula gives $a = +3'$; direct observation about $+7'$, provisionally $+5'$ may be adopted for the present.

† The formula gives $a = +10'$, but $+3'$ may be better.

‡ The formula gives $a = +7'$, but $+4'$ may be better.

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ.

[A + sign indicates west, a — sign east declination.]

GROUP I.—EASTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS.

Year (Jan. 1).	St. John's, Newfoundland.	Quebec, Canada.	Charlottetown, Pr. Edw. Id.	Montreal, Canada.	Eastport, Me.	Bangor, Me.	Halifax, N. S.	Burlington, Vt.	Hanover, N. H.	Portland, Me.	Rutland, Vt.	Portsmouth, N. H.
	°	°	°	°	°	°	°	°	°	°	°	°
1600					+19		+18					
10					19		17					
20					19		16·5					
30					18·5		15·5					
40		+17			18		15					
1650		17			17·5		14					
60	+16	17			17		13·5					
70	15	17·5			16		13					
80	14	17·5			15		12·5					
90	14	17			14·5		12					
1700	13·5	16·5		+15·5	13·7		12			+12		
10	13·5	15·5		15	13·0		11·5			11·4		
20	14	14·3		14	12·3		11·5			10·6		
30	14·5	13·3		13	11·9		12			9·9		
40	15·5	12·5		11·7	11·6		12			9·3		
1750	16·5	12·1		10·7	11·4		12·5			8·8		
60	18	12·1		9·7	11·4		13·0		+ 6·6	8·41		
70	19·5	12·2		8·8	11·6		13·7		6·1	8·18		+ 7·8
80	21	12·2		8·1	12·0		14·4		5·7	8·12	+ 6·8	7·6
90	23	12·2		7·7	12·6		15·1	+ 7·1	5·6	8·23	6·5	7·5
1800	24·5	12.1		7·5	13·2	+10·8	15·9	7·2	5·7	8·50	6·36	7·6
10	26	12.1		7·6	14·0	11·4	16·7	7·4	6·1	8·92	6·44	7·9
20	27·5	12·3		8·0	14·8	12·1	17·4	7·78	6·6	9·46	6·71	8·3
30	28·7	12·9	+20	8·7	15·6	12·9	18·2	8·29	7·3	10·10	7·18	8·9
40	29·7	13·8	21·2	9·5	16·4	13·7	18·9	8·90	8·1	10·82	7·80	9·55
1850	30·4	14·9	22·1	10·5	17·1	14·48	19·4	9·58	9·0	11·56	8·55	10·28
55	30·6	15·5	22·4	11·0	17·5	14·87	19·7	9·93	9·45	11·92	8·96	10·66
60	30·8	16·0	22·7	11·6	17·79	15·24	19·9	10·27	9·90	12·29	9·38	11·03
65	30·9	16·5	22·9	12·1	18·08	15·59	20·1	10·62	10·36	12·64	9·80	11·40
70	30·9	16·9	23·1	12·6	18·32	15·92	20·3	10·96	10·79	12·97	10·22	11·75
1875	30·8	17·2	23·2	13·2	18·53	16·22	20·5	11·28	11·20	13·29	10·64	12·09
80	30·6	17·4	23·2	13·7	18·71	16·48	20·6	11·58	11·59	13·58	11·05	12·40
85	30·4	17·5	23·2	14·2	18·84	16·71	20·7	11·86	11·94	13·85	11·44	12·69
90	30·1	17·5	23·1	14·6	18·92	16·89	20·7	12·11	12·26	14·08	11·80	12·94
95	29·7	17·5	22·9	15·0	18·97	17·03	20·7	12·33	12·53	14·27	12·13	13·16
1900	+29·3	+17·5	+22·7	+15·4	+19·0	+17·1	+20·7	+12·5	+12·8	+14·4	+12·4	+13·3

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP I.—EASTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	Chesterfield, N. H.	Newburyport, Mass.	Williamstown, Mass.	Albany, N. Y.	Salem, Mass.	Oxford, N. Y.	Cambridge, Mass.	Boston, Mass.	Provincetown, Mass.	Providence, R. I.	Hartford, Conn.	New Haven, Conn.
	°	°	°	°	°	°	°	°	°	°	°	°
1600				+10·5								
10				11								
20				11·5					+13			
30				12					13			
40				12					13			
1650				12					12·8			
60				12					12·4			
70				11·7					12·0			
80				11·3					11·4			
90				10·8					10·7			
1700				10·2			+10·3	+10·3	10·0			
10				9·5			9·6	9·6	9·3	+10·1	+ 9·3	
20				8·8			9·0	8·9	8·6	9·5	8·7	
30				8·1			8·4	8·3	7·9	8·7	8·0	
40				7·4			7·85	7·7	7·4	7·9	7·3	
1750		+ 8·0	+ 7·5	6·8	+ 7·8		7·41	7·3	7·0	7·2	6·6	+6·5
60		7·5	6·8	6·2	7·1		7·09	6·9	6·7	6·6	6·1	5·9
70		7·2	6·3	5·8	6·6		6·91	6·7	6·6	6·35	5·6	5·40
80		7·07	5·9	5·6	6·2		6·88	6·6	6·6	6·27	5·3	5·01
90		7·07	5·7	5·4	6·1	+3·0	6·99	6·73	6·8	6·22	5·1	4·77
1800		7·26	5·7	5·5	6·3	3·0	7·24	6·97	7·2	6·23	5·1	4·69
10	+ 5·9	7·60	5·9	5·67	6·6	3·1	7·63	7·35	7·7	6·47	5·3	4·78
20	6·2	8·07	6·3	6·02	7·2	3·4	8·12	7·84	8·2	6·95	5·58	5·04
30	6·98	8·65	6·8	6·49	7·9	3·9	8·70	8·42	8·92	7·67	6·02	5·44
40	7·97	9·31	7·4	7·07	8·7	4·46	9·32	9·06	9·63	8·49	6·59	5·97
1850	8·60	10·02	8·1	7·73	9·6	5·14	9·97	9·73	10·36	9·06	7·24	6·59
55	8·86	10·37	8·5	8·08	10·1	5·51	10·29	10·06	10·71	9·38	7·58	6·92
60	9·16	10·72	8·8	8·44	10·6	5·89	10·60	10·38	11·05	9·67	7·93	7·28
65	9·59	11·06	9·2	8·80	11·0	6·26	10·90	10·70	11·37	9·95	8·27	7·63
70	10·09	11·39	9·6	9·17	11·5	6·65	11·18	10·99	11·67	10·23	8·62	7·99
1875	10·59	11·70	10·0	9·52	11·9	7·02	11·44	11·27	11·95	10·53	8·97	8·34
80	11·01	11·99	10·3	9·87	12·30	7·38	11·68	11·53	12·20	10·85	9·29	8·69
85	11·27	12·25	10·6	10·21	12·65	7·72	11·90	11·76	12·42	11·17	9·60	9·01
90	11·38	12·48	10·9	10·52	12·97	8·05	12·08	11·96	12·60	11·48	9·89	9·33
95	11·44	12·7	11·2	10·82	13·2	8·35	12·23	12·1	12·75	11·75	10·2	9·62
1900	+11·5	+12·8	+11·4	+11·1	+13·5	+8·6	+12·4	+12·3	+12·9	+12·0	+10·4	+9·9

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP I.—EASTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	Nantucket, Mass.	Cold Spring Harbor, N. Y.	New York City and vicinity (N.Y. and N.J.).	South Bethlehem, Pa.	Huntingdon, Pa.	New Brunswick, N.J.	Jamesburg, N.J.	Harrisburg, Pa.	Hatboro, Pa.	Philadelphia, Pa.	Chambersburg, Pa.	West Creek, N.J.
	°	°	°	°	°	°	°	°	°	°	°	°
1600			+8									
10			8.5									
20			9									
30			9.5									
40			9.6									
1650			9.7									
60			9.7									
70			9.7									
80			9.6						+8.3			+8.3
90			9.1						8.2			8.2
1700	+ 9.1		8.5						7.9	+8.2		8.0
10	8.4		7.8						7.5	7.8		7.6
20	7.8		7.30						7.0	7.4		7.0
30	7.3		6.83						6.4	6.8	+4.45	6.4
40	6.8	+6.3	6.29	+6.1					5.7	6.2	3.83	5.66
1750	6.5	5.8	5.64	5.3	+3.9		+4.7		4.8	5.3	3.18	4.94
60	6.3	5.35	5.01	4.5	3.2		4.5		3.9	4.4	2.45	4.24
70	6.2	5.00	4.56	3.8	2.5		3.93		3.1	3.6	1.64	3.65
80	6.23	4.77	4.38	3.2	1.8		3.49		2.4	2.8	0.82	3.18
90	6.42	4.67	4.39	2.7	1.33	+2.3	3.21	+0.2	2.0	2.3	+0.12	2.86
1800	6.74	4.72	4.42	2.4	0.99	2.54	3.09	0.2	1.8	2.09	—0.35	2.73
10	7.17	4.90	4.46	2.2	0.84	2.93	3.15	0.4	2.0	2.16	—0.48	2.78
20	7.69	5.21	4.61	2.3	0.88	3.43	3.38	0.8	2.5	2.44	—0.28	3.01
30	8.29	5.63	4.98	2.5	1.11	4.02	3.77	1.4	3.0	2.91	+0.17	3.42
40	8.93	6.13	5.61	3.0	1.52	4.66	4.28	2.1	3.7	3.46	0.75	3.97
1850	9.57	6.69	6.31	3.53	2.07	5.32	4.91	2.90	4.3	4.07	1.38	4.62
55	9.89	6.99	6.62	3.86	2.40	5.66	5.25	3.31	4.6	4.39	1.70	4.97
60	10.21	7.28	6.91	4.22	2.74	5.98	5.60	3.70	5.0	4.73	2.02	5.34
65	10.51	7.58	7.16	4.59	3.10	6.29	5.96	4.09	5.3	5.08	2.35	5.70
70	10.79	7.87	7.40	4.98	3.48	6.59	6.32	4.46	5.7	5.44	2.70	6.06
1875	11.06	8.15	7.64	5.36	3.85	6.87	6.67	4.81	6.2	5.81	3.06	6.41
80	11.31	8.41	7.90	5.75	4.23	7.12	7.01	5.12	6.7	6.20	3.44	6.76
85	11.53	8.66	8.18	6.12	4.60	7.35	7.35	5.40	7.1	6.59	3.84	7.06
90	11.72	8.89	8.49	6.49	4.95	7.55	7.65	5.64	7.6	6.97	4.25	7.35
95	11.89	9.10	8.8	6.83	5.3	7.7	7.94	5.83	7.9	7.4[illegible]	4.65	7.6
1900	+12.03	+9.3	+9.1	+7.2	+5.6	+7.9	+8.2	+6.0	+8.0	+7.7	+5.03	+7.8

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP I.—EASTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	Baltimore, Md.	Cape May, N. J.	Washington, D.C.	Cape Henlopen, Del.	Williamsburg, Va.	Cape Henry, Va.	Newbern, N. C.	Milledgeville, Ga.	Charleston, S.C.	Savannah, Ga.	Fernandina, Fla.
	°	°	°	°	°	°	°	°	°	°	°
1600											
10											
20											
30											
40	+5										
1650	5·5										
60	6										
70	6										
80	6·1										
90	5·9			+7	+4·7						
1700	5·5	+6		6·4	4·6	+4·6			0·0		
10	5·1	5·9		5·8	4·4	4·3			—0·5		
20	4·5	5·5		5·2	4·0	3·9			1·2		
30	3·9	4·9		4·4	3·5	3·4			1·8		
40	3·2	4·3		3·7	2·9	2·9			2·5		
1750	2·55	3·8	+1·7	2·9	2·3	2·3	—0·6	—2	3·1	—2·1	
60	1·95	3·2	1·1	2·3	1·65	1·8	1·1	2·5	3·7	2·7	
70	1·43	2·7	0·6	1·7	1·05	1·2	1·6	3	4·1	3·3	
80	1·03	2·3	+0·2	1·2	0·52	0·8	1·9	4	4·4	3·8	
90	0·77	2·1	0·0	0·9	+0·10	0·45	2·1	4·5	4·55	4·2	
1800	0·66	1·9	—0·1	0·8	—0·17	0·24	2·1	5·0	4·55	4·5	
10	0·72	1·9	0·0	0·9	—0·28	0·17	1·96	5·3	4·37	4·7	
20	0·93	2·1	+0·2	1·1	—0·22	0·25	1·66	5·6	4·05	4·7	
30	1·29	2·35	0·65	1·5	+0·01	0·47	1·23	5·63	3·59	4·5	
40	1·77	2·75	1·17	2·00	0·38	0·82	0·70	5·55	3·03	4·2	—5
1850	2·35	3·23	1·77	2·64	0·88	1·27	—0·09	5·33	2·39	3·78	4·5
55	2·67	3·50	2·10	2·99	1·16	1·53	+0·22	5·17	2·06	3·53	4·2
60	2·99	3·78	2·43	3·36	1·47	1·80	0·54	4·98	1·73	3·25	3·8
65	3·32	4·07	2·77	3·73	1·78	2·08	0·86	4·76	1·39	2·96	3·5
70	3·65	4·37	3·10	4·11	2·10	2·37	1·17	4·51	1·07	2·65	3·2
1875	3·98	4·66	3·42	4·49	2·43	2·66	1·46	4·24	0·75	2·33	2·9
80	4·30	4·94	3·72	4·86	2·75	2·94	1·74	3·96	0·45	2·01	2·5
85	4·60	5·22	4·01	5·22	3·06	3·22	2·01	3·66	—0·17	1·69	2·2
90	4·89	5·48	4·28	5·56	3·35	3·48	2·25	3·4	+0·09	1·37	1·9
95	5·15	5·73	4·51	5·9	3·6	3·7	2·4	3·0	+0·32	1·06	1·6
1900	+5·4	+6·0	+4·7	+6·2	+3·9	+4·0	+2·6	—2·7	+0·5	—0·8	—1·2

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP II.—CENTRAL SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS.

Year (Jan. 1).	York Factory, Brit. North Am.	Fort Albany, Brit. North Am.	Duluth, Minn.	Sault de Ste. Marie, Mich.	Pierrepont Manor, N. Y.	Toronto, Canada.	Grand Haven, Mich.	Milwaukee, Wis.	Buffalo, N. Y.	Ithaca, N. Y.	Dunkirk, N. Y.	Detroit, Mich.	Kalamazoo, Mich.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1650													
60		+19.5											
70		20.5								+10			
80		21.5								10			
90		22.5								10			
1700		22.5								10			
10		22.5								10			
20	+21	22.5								9			
30	20	22								9			
40	17	21								8			
1750	15	20								7			
60	12	19								6			
70	9	17.5								5			
80	6	16								4.5			
90	3	15		0.0					+0.44	4	—0.5		
1800	+ 0.1	13.5		—0.5					0.22	3.3	—0.55	—3.1	
10	— 2.5	12		0.9					0.21	2.9	—0.46	3.06	
20	4.7	11		1.1	+2.6		—5.0		0.41	2.7	—0.21	2.84	—5.72
30	6.5	10		1.16	3.05	+0.8	5.2		0.79	2.8	+0.20	2.49	5.84
40	7.8	9		1.04	3.72	1.32	5.2		1.35	3.1	0.73	2.04	5.71
1850	8.5	9	— 9.8	0.76	4.52	1.60	4.95	—7.4	2.05	3.5	1.36	1.55	5.33
55	8.6	9	9.9	0.57	4.96	1.85	4.74	7.2	2.43	3.8	1.70	1.22	5.06
60	8.6	8.8	10.02	0.34	5.41	2.17	4.45	6.9	2.84	4.1	2.05	0.93	4.74
65	8.5	8.9	10.08	—0.07	5.87	2.39	4.11	6.6	3.25	4.5	2.40	0.64	4.37
70	8.2	9.1	10.11	+0.21	6.33	2.66	3.71	6.2	3.67	4.88	2.75	0.34	3.96
1875	7.7	9.3	10.10	0.52	6.79	3.14	3.25	5.8	4.09	5.29	3.10	—0.05	3.52
80	7.2	9.6	10.06	0.84	7.23	3.62	2.73	5.4	4.51	5.71	3.43	+0.23	3.04
85	6.4	9.9	9.98	1.18	7.65	3.88	2.15	5.0	4.91	6.14	3.75	0.49	2.55
90	5.6	10.3	9.9	1.52	8.0	4.12	1.6	4.5	5.30	6.58	4.05	0.74	2.04
95	4.6	11	9.7	1.9	8.4	4.50	—1	4.1	5.66	7.0	4.32	0.96	1.53
1900	— 3.6	+11.5	— 9.5	+2.2	+8.8	+4.8	....	—3.6	+6.0	+ 7.5	+ 4.6	+1.2	—1.0

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP II.—CENTRAL SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	Ypsilanti, Mich.	Erie, Pa.	Chicago, Ill.	Michigan City, Ind.	Cleveland, Ohio.	Omaha, Nebr.	Beaver, Pa.	Pittsburg, Pa.	Denver, Colo.	Marietta, Ohio.	Athens, Ohio.	Cincinnati, Ohio.	St. Louis, Mo.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1650													
60													
70													
80													
90													
1700													
10													
20													
30													
40													
1750													
60													
70													
80		+0·2					—0·4						
90		—0·2			—1·7		0·85				—4·0		
1800		0·46			1·76		1·15				4·1	4·9	
10	—4·0	0·52			1·66	—12·6	1·30			-2·9	4·1	5·0	
20	3·60	0·39	—6·12		1·43	12·64	1·28			2·8	3·9	5·0	
30	3·01	—0·09	6·28	—5·5	1·10	12·56	1·11			2·7	3·60	4·82	—8·9
40	2·29	+0·36	6·25	5·4	0·66	12·33	0·78	+0·18		2·33	3·15	4·51	8·6
1850	1·49	0·94	6·04	5·1	—0·16	11·96	0·32	0·68		1·86	2·61	4·08	8·2
55	1·07	1·26	5·88	4·9	+0·11	11·73	—0·06	0·96		1·57	2·31	3·83	8·0
60	0·65	1·60	5·67	4·6	0·39	11·47	+0·23	1·26	—15·14	1·27	2·00	3·57	7·7
65	—0·24	1·94	5·45	4·3	0·67	11·19	0·54	1·56	15·02	0·94	1·68	3·28	7·4
70	+0·18	2·30	5·15	4·03	0·96	10·89	0·86	1·87	14·88	0·60	1·36	2·99	7·1
1875	0·59	2·65	4·84	3·69	1·25	10·56	1·19	2·18	14·71	—0·26	1·04	2·69	6·7
80	0·96	2·99	4·52	3·34	1·52	10·23	1·52	2·49	14·52	+0·10	0·73	2·39	6·4
85	1·32	3·32	4·17	2·97	1·79	9·89	1·85	2·78	14·30	0·45	0·43	2·09	6·0
90	1·65	3·62	3·81	2·59	2·05	9·56	2·18	3·06	14·06	0·79	—0·14	1·80	5·6
95	1·95	3·9	3·45	2·21	2·29	9·2	2·49	3·3	—13·8	1·1	+0·12	1·5	5·3
1900	+2·2	+4·2	—3·1	—1·8	+2·5	— 8·9	+2·8	+3·5	....	+1·4	+0·4	—1·3	—5

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP II.—CENTRAL SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	Nashville, Tenn.	Florence, Ala.	Mobile, Ala.	Pensacola, Fla.	Austin, Tex.	New Orleans, La.	San Antonio, Tex.	Galveston, Tex.	Key West, Fla.	Habana, Cuba.	Kingston, Jamaica.	Bridgetown, Barbados.	Panama, New Granada.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1650													
60													
70													
80													
90													
1700						—2.3							
10						2.2							
20						2.4				—4	—4.9		
30						2.7				4.5	5.3		
40						3.1				5	5.6		
1750						3.7				5.5	5.9	—4.5	
60				—4.2		4.4				5.8	6.1	4.3	
70				4.9		5.1				6.1	6.2	4.1	—7.7
80				5.6		5.8				6.3	6.2	3.8	7.8
90				6.2		6.5				6.5	6.1	3.4	7.9
1800			—5.8	6.8		7.12			—7.2	6.5	6.0	3.0	7.9
10		—6.5	6.37	7.17		7.62			7.1	6.5	5.8	2.5	7.8
20	—6.7	6.58	6.78	7.42		7.96	— 9.8		6.86	6.3	5.5	2.1	7.6
30	6.9	6.54	7.03	7.50	—11	8.15	10.1		6.50	6.08	5.1	1.6	7.35
40	6.9	6.37	7.10	7.40	10.7	8.16	10.28	—8.8	6.03	5.77	4.7	1.1	7.05
1850	6.7	6.11	6.99	7.14	10.2	8.00	10.31	8.9	5.47	5.39	4.3	0.7	6.69
55	6.5	5.93	6.89	6.95	9.97	7.85	10.26	8.87	5.17	5.18	4.0	0.5	6.50
60	6.3	5.74	6.71	6.73	9.74	7.66	10.17	8.80	4.85	4.95	3.8	0.3	6.30
65	6.1	5.53	6.51	6.47	9.50	7.44	10.04	8.69	4.53	4.72	3.6	—0.1	6.09
70	5.78	5.30	6.27	6.19	9.27	7.18	9.87	8.55	4.21	4.48	3.3	+0.1	5.88
1875	5.46	5.06	6.01	5.88	9.03	6.90	9.67	8.37	3.88	4.23	3.1	0.2	5.67
80	5.13	4.81	5.71	5.55	8.80	6.59	9.44	8.16	3.57	3.97	2.9	0.4	5.46
85	4.78	4.55	5.39	5.21	8.57	6.26	9.18	7.91	3.26	3.72	2.7	0.5	5.25
90	4.40	4.28	5.05	4.85	8.34	5.91	8.90	7.62	2.96	3.46	2.5	0.6	5.0
95	4.0	4.02	4.69	4.50	8.1	5.56	8.59	7.29	2.7	3.21	2.3	0.7	4.8
1900	—3.6	—3.8	—4.3	—4.14	— 7.9	—5.20	— 8.3	—6.9	—2.4	—3.0	—2.1	+0.8	—4.6

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP III.—WESTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS.

Year (Jan. 1).	Chamisso Island, Kotzebue Sound, Alaska.	Port Clarence, Alaska.	Port Etches, Constantine Harbor, Alaska.	Port Mulgrave, Yakutat Bay, Alaska.	St. Paul, Kadiak Island, Alaska.	Sitka, Alaska.	Iliuliuk, Unalaska Island, Alaska.	Petropavlovok, Kamchatka.	Nootka, Vancouver, Island.	Cape Flattery and Neah Bay, Wash.	Port Townsend, Wash.
	°	°	°	°	°	°	°	°	°	°	°
1630											
40											
1650											
60											
70											
80											
90											
1700											
10											
20	—32	—28						—8·5			
30	32·6	29						8·5			
40	33·3	29·6						8·5			
1750	33·7	30·1						8·3			
60	34·1	30·4						8·1			
70	34·2	30·5	—22	—24	—22·2	—24·4		7·7	—18·6		
80	34·2	30·4	24	25	23·4	25·1	—18·4	7·2	18·8	—17·4	—16·8
90	34·0	30·2	26	26·4	24·5	25·7	18·9	6·7	19·2	17·9	17·42
1800	33·5	29·8	27·8	27·7	25·5	26·4	19·27	6·1	19·6	18·5	18·06
10	33·0	29·1	29·2	28·9	26·4	27·0	19·59	5·4	20·1	19·1	18·73
20	32·3	28·4	30·3	29·9	27·0	27·6	19·80	4·7	20·7	19·7	19·40
30	31·5	27·6	31·1	30·7	27·3	28·0	19·90	3·9	21·3	20·4	20·06
40	30·6	26·7	31·5	31·2	27·4	28·5	19·89	3·2	21·9	21·0	20·67
1850	29·7	25·7	31·5	31·4	27·2	29·1	19·76	2·4	22·5	21·60	21·22
55	29·2	25·3	31·3	31·5	26·9	29·1	19·65	2·1	22·8	21·88	21·48
60	28·8	24·8	31·0	31·4	26·6	29·0	19·52	1·7	23·1	22·12	21·71
65	28·4	24·4	30·7	31·3	26·3	29·0	19·37	1·3	23·3	22·35	21·91
70	27·9	24·0	30·3	31·2	25·9	29·1	19·19	1·0	23·5	22·56	22·10
1875	27·5	23·6	29·8	30·9	25·5	29·1	18·99	0·7	23·6	22·75	22·26
80	27·2	23·2	29·1	30·6	25·0	29·2	18·78	0·4	23·8	22·90	22·40
85	26·8	22·9	28·5	30·2	24·4	29·3	18·55	—0·1	23·9	23·04	22·50
90	—26	22·6	28	—30	23·9	29·4	18·31	+0·2	24·0	23·14	22·58
95	....	—22	—27	....	—23·2	29·4	18·1	+0·5	—24·0	23·21	22·63
1900	....	....	....	....	....	—29·4	—17·8	+0·7	....	—23·3	—22·7

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued

[A + sign indicates west, a — sign east declination.]

GROUP III.—WESTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	Seattle, Wash.	Olympia, Wash.	Cape Disappointment, Wash.	Wallawalla, Wash.	Vancouver, Wash.	Portland, Oreg.	Salt Lake City, Utah.	Cape Mendocino, Cal.	San Francisco, Cal.	Monterey, Cal.	Santa Barbara, Cal.
	°	°	°	°	°	°	°	°	°	°	°
1630											
40											
1650											
60											
70											
80											
90											
1700											— 8
10											8.2
20											8.3
30											8.5
40											
1750											8.9
60											9.3
70											9.8
80	—18.5	—16.5	—17.1		—14.7	—16		—14	—12.6	—11.4	10.4
90	19	17.0	17.3		15.3	16		14.5	13.1	11.8	11.0
1800	19.5	17.6	17.7		16.1	16.7		15	13.6	12.3	11.6
10	20	18.2	18.2		16.9	17.3		15.5	14.1	12.9	12.3
20	20.5	18.8	18.7		17.7	18.0		16	14.6	13.4	12.9
30	20.9	19.4	19.2		18.5	18.8		16.5	15.01	13.93	13.43
40	21.3	20.1	19.8		19.3	19.5		16.9	15.43	14.45	13.90
1850	21.7	20.65	20.31	—20.3	19.98	20.3	—15.8	17.2	15.80	14.91	14.30
55	21.85	20.91	20.56	20.6	20.28	20.6	16.08	17.3	15.96	15.13	14.46
60	21.96	21.17	20.80	20.8	20.57	21.0	16.27	17.4	16.11	15.32	14.60
65	22.11	21.41	21.02	21.0	20.81	21.3	16.43	17.5	16.25	15.49	14.70
70	22.22	21.63	21.22	21.2	21.02	21.5	16.54	17.6	16.36	15.65	14.78
1875	22.31	21.83	21.40	21.3	21.19	21.8	16.60	17.6	16.50	15.78	14.82
80	22.39	22.01	21.56	21.3	21.32	22.0	16.61	17.7	16.57	15.89	14.84
85	22.44	22.16	21.69	21.3	21.41	22.2	16.56	17.7	16.56	15.98	14.82
90	22.48	22.29	21.79	21.2	21.45	22.3	16.46	17.7	16.64	16.04	14.8
95	22.49	22.39	21.87	—21.1	21.5	22.4	16.31	—17.7	16.73	16.1	14.7
1900	—22.5	—22.5	—21.9	....	—21.4	—22.5	—16.1	....	—16.7	—16.1	—14.6

SYNOPSIS OF RESULTS OF THE SECULAR VARIATION OF THE MAGNETIC DECLINATION—Continued.

Decennial and quinquennial tabular values of the magnetic declination computed by preceding formulæ—Continued.

[A + sign indicates west, a — sign east declination.]

GROUP III.—WESTERN SUBDIVISION OF THE UNITED STATES AND ADJACENT PARTS—Continued.

Year (Jan. 1).	San Diego, Cal.	El Paso, Tex.	Cerros Island, Low. Cal., Mex.	Ascension Island, Low. Cal., Mex.	Magdalena Bay, Low. Cal., Mex.	San Lucas, Low. Cal., Mex.	San Blas, Mexico.	Mexico City, Mexico.	Vera Cruz, Mexico.	Acapulco, Mexico.
	°	°	°	°	°	°	°	°	°	°
1630							—4.4			
40							3.6			
1650							2.9			
60							2.2			
70							1.6			
80							1.2			
90							1.0			
1700						—2.6	0.9			
10	— 7		— 3		— 2	2.4	0.9			
20	7.3		3.3		2.2	2.3	1.2		—3.0	
30	7.5		3.7		2.3	2.3	1.6		3.7	
40	7.7		4.3		2.5	2.5	2.1		4.4	—3.3
1750	8.1		5.0		3.0	2.9	2.8		5.1	4.0
60	8.5		5.7		3.5	3.4	3.6	—5.4	5.8	4.8
70	9.0		6.5		4.2	4.0	4.4	6.0	6.6	5.6
80	9.5		7.4	— 7.7	4.9	4.6	5.3	6.6	7.2	6.3
90	10.1		8.2	8.2	5.7	5.4	6.1	7.1	7.8	7.0
1800	10.7		9.0	8.8	6.6	6.2	6.9	7.5	8.3	7.6
10	11.26		9.8	9.35	7.4	6.9	7.66	7.9	8.7	8.1
20	11.79		10.5	9.86	8.2	7.6	8.30	8.2	9.0	8.5
30	12.27		11.0	10.32	8.9	8.26	8.81	8.5	9.1	8.7
40	12.67		11.5	10.69	9.5	8.81	9.18	8.6	9.0	8.9
1850	12.99	—12.14	11.81	10.98	9.97	9.23	9.38	8.62	8.82	8.88
55	13.11	12.26	11.91	11.09	10.15	9.38	9.42	8.59	8.66	8.83
60	13.21	12.34	11.98	11.17	10.30	9.50	9.41	8.55	8.48	8.75
65	13.28	12.38	12.01	11.23	10.41	9.56	9.36	8.48	8.27	8.64
70	13.32	12.38	12.00	11.26	10.47	9.62	9.27	8.39	8.02	8.50
1875	13.34	12.32	11.95	11.26	10.50	9.61	9.14	8.26	7.75	8.33
80	13.32	12.23	11.86	11.23	10.48	9.57	8.97	8.13	7.46	8.12
85	13.28	12.10	11.74	11.18	10.42	9.49	8.76	7.96	7.14	7.89
90	13.2	11.93	11.58	11.09	10.3	9.37	8.5	7.77	6.80	7.64
95	13.1	11.72	11.4	11.0	10.2	9.2	8.2	7.66	6.4	7.36
1900	—13	—11.5	—11.2	—10.8	—10	—9	—8	—7.4	—6.1	—7.1

Collection of results of the secular variation of the magnectic dip and intensity.

RESULTS FOR SECULAR VARIATION AND ANNUAL CHANGE OF THE DIP.

[Collection of preceding expressions and deductions.]

Name of station.	Time range (between years).	Dip expressed as a function of time. (m = year — 1850·0)	Approximate annual change (1895). + increase. — decrease.	Approximate epoch. Max. dip.
GROUP I.				
St. John's, N. F.	1881–1883	....	(?)′	....
Quebec, Can.	1842–1879	....	—1·6	....
Charlottetown, Prin. Edw. Isd.	....	....	......	....
Montreal, Can.	1833–1879	$\Theta = 77^{\circ}{\cdot}08 - 0{\cdot}011\,1\, m - 0{\cdot}000\,382\, m^2$	—2·7	1836
Eastport, Me.	1860–1895	$\Theta = 76^{\circ}{\cdot}31 - 0{\cdot}039\,2\, m + 0{\cdot}000\,053\, m^2$	—2·1	....
Bangor, Me.	1841–1895	$\Theta = 76^{\circ}{\cdot}23 - 0{\cdot}005\,2\, m - 0{\cdot}000\,497\, m^2$	—3·0	1845
Halifax, N. S.	1834–1881	$\Theta = 74^{\circ}{\cdot}94 - 0{\cdot}016\,1\, m$	—1·0	....
Burlington, Vt.	1845–1890	$\Theta = 75^{\circ}{\cdot}78 - 0{\cdot}019\,1\, m$	—1·2	....
Hanover, N. H.	1873–1890	....	—1·8	....
Portland, Me.	1845–1895	$\Theta = 75^{\circ}{\cdot}21 + 0{\cdot}001\,1\, m - 0{\cdot}000\,548\, m^2$	—2·9	1850
Rutland, Vt.	1859–1890	$\Theta = 75^{\circ}{\cdot}70 - 0{\cdot}031\,0\, m$	—1·8	....
Portsmouth, N. H.	1850–1890	$\Theta = 75^{\circ}{\cdot}12 - 0{\cdot}024\,0\, m$	—1·4	....
Chesterfield, N. H.	1874–1890	....	—1·9	....
Newburyport, Mass.	1850–1887	....	—1·9	....
Williamstown, Mass.	1876	....	......	....
Albany, N. Y.	1833–1890	$\Theta = 74^{\circ}{\cdot}91 + 0{\cdot}003\,7\, m - 0{\cdot}000\,653\, m$	—3·3	1853
Salem, Mass.	1855–1887	....	—2·3	....
Oxford, N. Y.	1874–1885	....	—1·8	....
Cambridge, Mass.	1780–1895	$\Theta = 71^{\circ}{\cdot}22 + 3^{\circ}{\cdot}28 \sin (1{\cdot}5\, m + 76^{\circ}{\cdot}3)$	—4·2	1858
Boston, Mass.	1722–1890	$\Theta = 71^{\circ}{\cdot}23 + 3^{\circ}{\cdot}10 \sin (1{\cdot}5\, m + 79{\cdot}2)$	—4·1	1857
Provincetown, Mass.	1860–1895	....	—1·9	....
Providence, R. I.	1834–1895	$\Theta = 74^{\circ}{\cdot}11 - 0{\cdot}001\,4\, m - 0{\cdot}000\,614\, m^2$	—3·4	1851
Hartford, Conn.	1839–1890	$\Theta = 73^{\circ}{\cdot}94 - 0{\cdot}010\,9\, m - 0{\cdot}000\,250\, m^2$	—2·0	1828
New Haven, Conn.	1839–1895	$\Theta = 73^{\circ}{\cdot}55 + 0{\cdot}003\,5\, m - 0{\cdot}000\,642\, m^2$	—3·2	1853
Nantucket, Mass.	1843–1895	$\Theta = 73^{\circ}{\cdot}80 + 0{\cdot}002\,8\, m - 0{\cdot}000\,633\, m^2$	—3·2	1852
Cold Spring Harbor, N. Y.	1844–1865	....	(?)	....
New York City, N. Y.	1822–1895	$\Theta = 72^{\circ}{\cdot}73 - 0{\cdot}009\,8\, m - 0{\cdot}000\,160\, m^2$	—1·4	....
South Bethlehem, Pa.	1841–1874	....	(?)	....
Huntingdon, Pa.	1840	....	......	....
New Brunswick, N. J.	1844–1895	....	(?)	....
Jamesburg, N. J.	....	....	......	....
Harrisburg, Pa.	1840–1895	$\Theta = 72^{\circ}{\cdot}48 + 0{\cdot}006\,7\, m - 0{\cdot}000\,563\, m^2$	—2·6	1856
Hatboro, Pa.	....	....	......	....
Philadelphia, Pa.	1834–1895	$\Theta = 72^{\circ}{\cdot}13 + 0{\cdot}010\,1\, m - 0{\cdot}000\,743\, m^2$	—3·4	1857
Chambersburg, Pa.	1842	....	......	....
West Creek, L. Egg Hbr. N. J.	1846–1860	....	......	....
Baltimore, Md.	1834–1895	$\Theta = 71^{\circ}{\cdot}74 + 0{\cdot}014\,5\, m - 0{\cdot}000\,752\, m^2$	—3·2	1860
Cape May, N. J.	1846–1891	....	—2·1	....
Washington, D. C.	1838–1895	$\Theta = 71^{\circ}{\cdot}36 - 0{\cdot}002\,27\, m - 0{\cdot}000\,540\, m^2$	—3·0	1884
Cape Henlopen, Del.	1846–1885	....	—1·2	....
Williamsburg, Va.	1874–1887	....	—2·4	....
Cape Henry, Va.	1856–1895	$\Theta = 70^{\circ}{\cdot}04 - 0{\cdot}035\,9\, m$	—2·2	....
Newbern, N. C.	1874–1887	....	—2·2	....
Milledgeville, Ga.	1887	....	......	....
Charleston, S. C.	1849–1895	$\Theta = 64^{\circ}{\cdot}53 - 0{\cdot}012\,1\, m$	—0·7(?)	
Savannah, Ga.	1852–1895	$\Theta = 63^{\circ}{\cdot}63 + 0{\cdot}021\,1\, m - 0{\cdot}000\,682\, m^2$	—2·5	1865
Fernandina, Fla.	1857–1879	....	......	....
GROUP II.				
York Factory, B. N. A.	1843–1884	....	(?)	....
Fort Albany, B. N. A.	1775	....	......	....
Duluth, Minn.	1859–1891	....	(?)	....
Sault de Ste Marie, Mich.	1841–1891	$\Theta = 77^{\circ}{\cdot}63 + 0{\cdot}011\,68\, m - 0{\cdot}000\,653\, m^2$	—2·8	1859
Pierrepont Manor, N. Y.	1874	....	......	....
Toronto, Can.	1843–1895	$\Theta = 75^{\circ}{\cdot}34 + 0{\cdot}008\,784\, m - 0{\cdot}000\,589\, m^2$	—2·6	1858
Grand Haven, Mich.	1859–1891	$\Theta = 74^{\circ}{\cdot}37 - 0{\cdot}017\,8\, m$	—1·1(?)	....
Milwaukee, Wis.	1859–1888	....	(?)	....
Buffalo, N. Y.	1839–1885	$\Theta = 74^{\circ}{\cdot}74 + 0{\cdot}010\,1\, m - 0{\cdot}000\,756\, m^2$	—3·5	1857
Ithaca, N. Y.	1874–1890	....	—1·5(?)	....
Dunkirk, N. Y.	1841	....	......	....

Collection of results of the secular variation of the magnetic dip and intensity—**Continued.**

RESULTS FOR SECULAR VARIATION AND ANNUAL CHANGE OF THE DIP—Continued.

Name of station.	Time range (between years).	Dip expressed as a function of time. (m = year − 1850·0)	Approximate annual change (1895). + increase. − decrease.	Approximate epoch. Max. dip.
GROUP II—continued.				
Detroit, Mich.	1839–1891	$\Theta = 73°.67 + 0.008\,41\,m - 0.000\,545\,m^2$	−2·4	1858
Kalamazoo, Mich.	....	....	......	....
Ypsilanti, Mich.	1839–1841	....	......	....
Erie, Pa.	1841–1885	$\Theta = 73°.89 + 0.013\,85\,m - 0.000\,786\,m^2$	−3·4	1859
Chicago, Ill.	1841–1891	$\Theta = 72°.74 - 0.000\,34\,m - 0.000\,167\,m^2$	−0·9	1850
Michigan City, Ind.	1859–1891	$\Theta = 73°.20 - 0.019\,m$	−1·1	....
Cleveland, Ohio.	1839–1891	$\Theta = 73°.26 + 0.002\,4\,m - 0.000\,372\,m^2$	−1·9	1853
Omaha, Nebr.	1869–1891	....	−0·8	1877(?(
Beaver, Pa.	1839–1874	....	......	....
Pittsburg, Pa.	1819–1885	....	......	....
Denver, Colo.	1872–1888	....	−0·3(?)	....
Marietta, Ohio.	1845	....	......	....
Athens, Ohio.	1880	....	......	....
Cincinnati, Ohio.	1838–1888	....	−0·7(?)	....
St. Louis, Mo.	1819–1886	Θ Nearly stationary since 1836	0·0	....
Nashville, Tenn.	1833–1888	....	−1·4	....
Florence, Ala.	1881–1890	....	−2·4	....
Mobile, Ala.	1834–1857	....	......	....
Pensacola, Fla.	1858–1895	....	−0·4(?)	....
Austin, Tex.	1878–1895	....	+0·4(?)	....
New Orleans, La.	1834–1895	....	0·0	....
San Antonio, Tex.	1878–1895	....	+0·2	....
Galveston, Tex.	1848–1895	....	+2·9	....
Key West, Fla.	1849–1887	$\Theta = 54°.60 - 0.004\,4\,m$	−0·3	....
Habana, Cuba.	1801–1889	....	−0·8	....
Kingston, Jamaica.	1822–1857	....	......	....
Bridgetown, Barbados.	1722–1846	....	......	....
Panama, New Granada.	1790–1866	....	......	....
GROUP III.				
Chamisso Island, Alaska.	1827–1880	....	......	....
Port Clarence, Alaska.	1850–1880	....	(?)	....
Port Etches, Constantine Harbor.	1837	....	......	....
Port Mulgrave, Yakutat Bay.	1791 1892	....	−0·5(?)	....
St. Paul, Kadiak Island.	1880	....	......	....
Sitka, Alaska.	1818–1894	$\Theta = 75°.67 - 0.017\,5\,m + 0.000\,064\,m^2$	−0·7	....
Iliuliuk, Unalaska Island.	1778–1891	$\Theta = 68°.13 - 0.017\,9\,m - 0.000\,023\,m^2$	−1·2	....
Petropavlovsk, Kamchatka.	1779–1876	$\Theta = 64°.28 + 0.008\,7\,m - 0.000\,134\,m^2$	−0·2	1882
Nootka, Vancouver Island.	1778–1881	....	(?)	....
Cape Flattery, Wash.	1855–1881	....	0·0(?)	....
Port Townsend, Wash.	1792–1894	....	+1·0(?)	....
Seattle, Wash.	1871–1895	....	−0·3(?)	....
Olympia, Wash.	1894	....	......	....
Cape Disappointment, Wash.	1830–1895	....	0·0(?)	....
Wallawalla, Wash.	1830–1887	....	−0·8(?)	....
Vancouver, Wash.	1830–1895	....	0·0(?)	....
Portland, Oreg.	1858–1895	....	+0·7(?)	....
Salt Lake City, Utah.	1869–1893	....	0·0(?)	....
Mendocino City, Cal.	1886	....	......	....
San Francisco, Cal.	1815–1896	$\Theta = 62°.24 + 0.011\,3\,m - 0.000\,168\,m^2$	−0·2	1884
Monterey, Cal.	1791–1896	$\Theta = 61°.55 - 0.016\,6\,m + 0.000\,180\,m^2$	0·0	1896
Santa Barbara, Cal.	1831–1881	....	+0·6(?)	....
San Diego, Cal.	1793–1892	$\Theta = 57°.51 + 0.029\,2\,m - 0.000\,452\,m^2$	−0·7(?)	....
El Paso, Tex.	1852–1895	....	+1·6	....
Cerros Island, Low. Cal.	1873–1888	....	+1·6(?)	....
Ascension Island, Low. Cal.	1881–1889	....	+1·2	....
Magdalena Bay, Low. Cal.	1837–1881	....	+0·8(?)	....
San Lucas, Low. Cal.	1839–1881	....	+2·5(?)	....
San Blas, Mex.	1791–1880	....	+2·5(?)	....
Mexico City, Mex.	1778–1895	....	......	....
Vera Cruz, Mex.	1856–1888	....	+0·5	....
Acapulco, Mex.	1791–1892	$\Theta = 39°.05 + 0.033\,9\,m$	+2·0	....

The preceding table of results for the secular variation of the dip at stations in the eastern, central, and western parts of the United States exhibits, as a broad feature, over a large area, a slowly diminishing dip at the present time. This region is roughly defined by a spherical quadrilateral with angles in Nova Scotia, Cuba, Bay of Monterey, and Strait of Juan de Fuca. The average annual decrease within this area is, at 36 stations of Group I to which Key West and Habana were added 2′·2; at 16 stations of Group II but exclusive of New Orleans and other stations to the south 1′·7, and at 9 stations of Group III the motion may be said to have begun but recently, thus making it difficult to be certain of it. On the other hand, south of the line from Cuba to Monterey the dip everywhere (within our limits of research) is found to be increasing, its annual rate from 10 stations being 1′·3; this includes the area of Lower California and of Mexico as far south as Acapulco. This band of demarcation of diminishing and increasing dip in its secular change is marked on accompanying chart, as near as can be done with our imperfect data. It will be noted that already in 1885 (Appendix No. 6, Report for 1885) this feature had been made out, although based upon much less secure ground and in part conjectural; in fact, the reversal in the secular motion over the Eastern States from a previous increase to a decrease which took place about 1859 (as then made out) was the main cause of obscuration at the earlier time of investigation; nothing could be inferred as to changes in the dip at western stations. According to our table the dip reached a maximum value about the year 1851 ± 6 years in the eastern part of the United States and about the year 1859 ± 5 in the Central States. At San Francisco and Monterey the year 1890 is indicated. This later occurrence of the epoch of maximum dip as we proceed from east to west is in exact accord with the known westward sweep over the country of the secular change phases of the magnetic declination. The band of stationary dip at this time is slowly shifting its position to the southward.

RESULTS FOR SECULAR VARIATION AND ANNUAL CHANGE OF THE HORIZONTAL COMPONENT OF THE MAGNETIC FORCE.

[Collection of preceding expressions and deductions.]

Name of station.	Time range (between years).	Horizontal component H (m = year—1850·0)	Approximate annual change $\frac{a}{H}$ + increasing. — decreasing.	Approximate epoch of minimum H.
GROUP I.				
St. John's, N. F.	1881–1883	....	....	....
Quebec, Can.	1842–1879	....	+0·0018	....
Charlottetown, Pr. Edw. Isd.	....	....	....	....
Montreal, Can.	1842–1879	$H = 0{\cdot}1402 + 0{\cdot}000\ 015\ m + 0{\cdot}000\ 007\ 3\ m^2$	+0·0043	1849
Eastport, Me.	1860–1895	$H = 0{\cdot}1502 + 0{\cdot}000\ 183\ m + 0{\cdot}000\ 000\ 6\ m^2$	+0·0015	....
Bangor, Me.	1857–1895	$H = 0{\cdot}1472 + 0{\cdot}000\ 117\ m + 0{\cdot}000\ 001\ 5\ m^2$	+0·0017	1812 (?)
Halifax, N. S.	1834–1881	$H = 0{\cdot}1518 + 0{\cdot}000\ 130\ m + 0{\cdot}000\ 002\ 9\ m^2$	+0·0022	1827
Burlington, Vt.	1845–1890	$H = 0{\cdot}1569 + 0{\cdot}000\ 078\ m$	+0·0005	....
Hanover, N. H.	1873–1890	....	+0·0005	....
Portland, Me.	1845–1895	$H = 0{\cdot}1585 - 0{\cdot}000\ 017\ m + 0{\cdot}000\ 004\ 0\ m^2$	+0·0020	1852
Rutland, Vt.	1859–1890	....	+0·0011	....
Portsmouth, N. H.	1850–1890	....	+0·0009	....
Chesterfield, N. H.	1874–1890	....	+0·0007	....
Newburyport, Mass.	1850–1887	....	+0·0007	....
Williamstown, Mass.	1876	....	....	....
Albany, N. Y.	1835–1890	$H = 0{\cdot}1652 + 0{\cdot}000\ 033\ m + 0{\cdot}000\ 001\ 0\ m^2$	+0·0008	1834
Salem, Mass.	1849–1887	....	+0·0004	....
Oxford, N. Y.	1874–1885	....	(?)	....
Cambridge, Mass.	1842–1895	$H = 0{\cdot}1661 - 0{\cdot}000\ 090\ m + 0{\cdot}000\ 005\ 8\ m^2$	+0·0024	1858
Boston, Mass.	1839–1890	$H = 0{\cdot}1660 - 0{\cdot}000\ 121\ m + 0{\cdot}000\ 007\ 4\ m^2$	+0·0032	1858
Provincetown, Mass.	1860–1895	....	+0·0009	....
Providence, R. I.	1835–1895	$H = 0{\cdot}1686 - 0{\cdot}000\ 198\ m + 0{\cdot}000\ 009\ 5\ m^2$	+0.0037	1860
Hartford, Conn.	1859–1890	....	+0·0003	....
New Haven, Conn.	1839–1895	$H = 0{\cdot}1731 - 0{\cdot}000\ 151\ m + 0{\cdot}000\ 008\ 2\ m^2$	+0·0032	1859
Nantucket, Mass.	1846–1895	$H = 0{\cdot}1680 + 0{\cdot}000\ 281\ m - 0{\cdot}000\ 001\ 2\ m^2$	+0·0010	....

RESULTS FOR SECULAR VARIATION AND ANNUAL CHANGE OF THE HORIZONTAL COMPONENT OF THE MAGNETIC FORCE—Continued.

Name of station.	Time range (between years).	Horizontal component H (m = year — 1850·0)	Approximate annual change $\frac{a}{H}$ + increasing. — decreasing.	Approximate epoch of minimum H.
GROUP I—continued.				
Cold Spring Harbor, N. Y.	1844–1865	....	......	....
New York City, N. Y.	1822–1895	$H = 0{\cdot}1847 + 0{\cdot}000\,024\,m + 0{\cdot}000\,000\,5\,m^2$	+0·0004	1826 (?)
South Bethlehem, Pa.	1841–1874	....	......	....
Huntingdon, Pa.	1840	....	......	....
New Brunswick, N. J.	1844–1895	....	+0·0003	....
Jamesburg, N. J.	......	....	......	....
Harrisburg, Pa.	1840–1895	....	+0·0005 (?)	....
Hatboro, Pa.	......	....	......	....
Philadelphia, Pa.	1835–1895	$H = 0{\cdot}1918 — 0{\cdot}000\,022\,m + 0{\cdot}000\,002\,0\,m^2$	+0·0008	1855
Chambersburg, Pa.	1842	....	......	....
West Creek, Lit. Egg Hbr., N. J.	1846–1860	....	......	....
Baltimore, Md.	1832–1895	$H = 0{\cdot}1952 — 0{\cdot}000\,027\,m + 0{\cdot}000\,000\,72\,m^2$	+0·0002	1869
Cape May, N. J.	1846–1891	$H = 0{\cdot}1951 — 0{\cdot}000\,073\,m + 0{\cdot}000\,004\,66\,m^2$	+0·0018	1858
Washington, D. C.	1842–1895	$H = 0{\cdot}1979 + 0.000\,123\,m — 0{\cdot}000\,000\,717\,m^2$	+0·0002	....
Cape Henlopen, Del.	1846–1885	....	+0·0000 (?)	....
Williamsburg, Va.	1874–1887	....	(?)	....
Cape Henry, Va.	1856–1895	....	+0·0014 (?)	....
Newbern, N. C.	1874–1887	....	(?)	....
Milledgeville, Ga.	1887	....	......	....
Charleston, S. C.	1833–1895	....	—0·0010 (?)	....
Savannah, Ga.	1852–1895	....	—0·0004 (?)	....
Fernandina, Fla.	1857–1879	....	......	....
GROUP II.				
York Factory, Brt. North Am.	1843–1884	....	......	....
Fort Albany, Brt. North Am.	......	....	......	....
Duluth, Minn.	1859–1891	....	—0·0003 (?)	....
Sault de Ste. Marie, Mich.	1843–1891	....	+0·0013 (?)	....
Pierrepont Manor, N. Y.	1874–1884	....	(?)	....
Toronto, Can.	1842–1895	$H = 0{\cdot}1623 — 0{\cdot}000\,154\,m + 0{\cdot}000\,006\,m^2$	+0·0022	1863
Grand Haven, Mich.	1859–1891	....	0·0000	....
Milwaukee, Wis.	1859–1888	....	—0·0012 (?)	....
Buffalo, N. Y.	1844–1885	$H = 0{\cdot}1676 — 0{\cdot}000\,063\,m + 0{\cdot}000\,003\,4\,m^2$	+0·0014	1859
Ithaca, N. Y.	1874–1890	....	(?)	....
Dunkirk, N. Y.	1841	....	......	....
Detroit, Mich.	1843–1891	$H = 0{\cdot}1787 — 0{\cdot}000\,054\,m + 0{\cdot}000\,002\,2\,m^2$	+0·0008	1862
Kalamazoo, Mich.	......	....	......	....
Ypsilanti, Mich.	......	....	......	....
Erie, Pa.	1841–1885	$H = 0{\cdot}1743 — 0{\cdot}000\,018\,m + 0{\cdot}000\,002\,5\,m^2$	+0·0011	1854
Chicago, Ill.	1842–1891	....	—0·0020 (?)	....
Michigan City, Ind.	1859–1891	....	—0·0007 (?)	....
Cleveland, Ohio.	1842–1891	....	(?)	....
Omaha, Nebr.	1869–1891	....	(?)	....
Beaver, Pa.	1874	....	......	....
Pittsburg, Pa.	1840–1885	$H = 0{\cdot}1889 + 0{\cdot}000\,213\,m — 0{\cdot}000\,006\,8\,m^2$	—0·0022	1865
Denver, Colo.	1873–1888	....	—0·0011	....
Marietta, Ohio.	......	....	......	....
Athens, Ohio.	1880	....	......	....
Cincinnati, Ohio.	1844–1888	....	—0·0007	....
St. Louis, Mo.	1835–1886	....	(?)	....
Nashville, Tenn.	1877–1888	....	—0·0017	....
Florence, Ala.	1881–1890	....	—0·0012	....
Mobile, Ala.	1834–1857	....	......	....
Pensacola, Fla.	1858–1895	....	—0·0015	....
Austin, Tex.	1878–1895	....	—0·0012	....
New Orleans, La.	1856–1895	$H = 0{\cdot}2943 — 0{\cdot}000\,334\,m$	—0·0012	....
San Antonio, Tex.	1878–1895	....	—0·0009	....
Galveston, Tex.	1848–1895	$H = 0{\cdot}3016 — 0{\cdot}000\,281\,m$	—0·0010	....
Key West, Fla.	1849–1887	....	—0·0009	....

RESULTS FOR SECULAR VARIATION AND ANNUAL CHANGE OF THE HORIZONTAL COMPONENT OF THE MAGNETIC FORCE—Continued.

Name of station.	Time range (between years.)	Horizontal component H (m = year — 1850·0)	Approximate annual change $\frac{a}{H}$ + increasing. − decreasing.	Approximate epoch of maximum. H.
GROUP II—continued.				
Habana, Cuba.	1822–1886	....	—0·0007	....
Kingston, Jamaica.	1834–1857	....	......	....
Bridgetown, Barbados.	1835–1836	....	......	....
Panama, New Granada.	1837–1866	....	—0.0006 (?)	....
GROUP III.				
Chamisso Island, Alaska.	1880	....	......	....
Port Clarence, Alaska.	1879–1880	....	......	....
Port Etches, Constantine Hbr.	1837	....	......	....
Port Mulgrave, Yakutat Bay.	1880–1892	....	+0·0005	....
St. Paul, Kadiak Island.	1880	....	......	....
Sitka, Alaska.	1839–1894	$H = 0·1490 + 0·000\ 098\ m$	+0·0007	....
Iliuliuk, Unalaska.	1880–1891	....	+0·0009	....
Petropavlovsk, Kamchatka.	1837	....	......	....
Nootka, Vancouver Id.	1881	....	......	....
Cape Flattery, Wash.	1852–1881	....	—0·0001	....
Port Townsend, Wash.	1881–1894	....	—0·0033	....
Seattle, Wash.	1871–1894	....	—0·0006	....
Olympia, Wash.	1881–1894	....	(?)	....
Cape Disappointment, Wash.	1873–1895	....	—0·0004	....
Wallawalla, Wash.	1830–1887	....	—0·0002	....
Vancouver, Wash.	1830–1895	....	—0·0002	....
Portland, Oreg.	1880–1895	....	—0·0009	....
Salt Lake City, Utah.	1869–1893	$H = 0·2347 — 0·000\ 134\ m$	—0·0006	....
Mendocino City, Cal.	1886	....	......	....
San Francisco, Cal.	1831–1896	$H = 0·2568 + 0·000\ 090\ m — 0·000\ 005\ m^2$	—0·0015	1861
Monterey, Cal.	1831–1896	$H = 0·2640 + 0·000\ 123\ m — 0·000\ 005\ m^2$	—0·0014	1862
Santa Barbara, Cal.	1831–1881	$H = 0·2760 + 0·000\ 139\ m — 0·000\ 010\ m^2$	—0·0028	1857
San Diego, Cal.	1839–1892	$H = 0·2870 + 0·000\ 173\ m — 0·000\ 010\ m^2$	—0·0025	1859
El Paso, Tex.	1888–1895	....	(?)	....
Cerros Id., Low. Cal.	1873–1888	....	(?)	....
Ascension Id., Low. Cal.	1881–1889	....	(?)	....
Magdalena Bay, Low. Cal.	1839–1881	....	(?)	....
San Lucas, Low. Cal.	1839–1881	....	(?)	....
San Blas, Mex.	1839–1880	....	(?)	....
Mexico City, Mex.	1857–1895	....	—0·0014	....
Vera Cruz, Mex.	1856–1880	....	—0·0008 (?)	....
Acapulco, Mex.	1838–1892	....	—0·0008	....

A glance at the preceding table of the secular change of the horizontal component of the force about the period 1895 shows an annual *increase* only for the northeastern part of the United States and for an undefined space about Sitka, Yakutat, and Unalaska, Alaska. At all other stations the value of H appears to be on the *decrease*, and this conclusion holds probably for the whole of Mexico and as far south as Panama. It would seem that the band of no annual change of H as given on the 1885 chart was placed too far south; at any rate the present investigation, with the aid of slightly better means, makes it cross Lake Erie and the coast at Cape Fear (see accompanying chart).

Within the region of present increasing H its value has lately passed through a minimum, for which epoch 12 stations indicate the year 1852; the annual change, or $a / H = + 0·0014$ is derived from 29 stations. Over the vast region to the west of the band of no change the annual change is about $-0·0013$ (as deduced from 39 stations).

In case the annual change of the total force or of its vertical component should be desired, the change in terms of the force can readily be had from the expressions:

$$\frac{dF}{F} = \frac{dH}{H} + \tan\theta\, d\theta \quad \text{and} \quad \frac{dV}{V} = \frac{dH}{H} + \frac{d\theta}{\sin\theta\cos\theta}$$

THE SECULAR VARIATION IN THE DIRECTION OF A FREELY SUSPENDED MAGNETIC NEEDLE.

While in the former investigations of the secular variation in the direction of the magnetic force, we treated the changes in the declination and in the dip separately, there is a decided advantage in studying and representing graphically their combined effect, as already remarked in a preceding part of this paper. For this purpose, tables of decennial values of D and θ were introduced for all stations where the respective observations were sufficiently numerous and accurate and extended over a sufficient length of time to make the results available for further study or for graphical representation.

In Group I there are 23 such stations, in Group II only 10, and in Group III there are but 7 stations at which the direction of the secular motion can be more or less distinctly recognized. From these stations I have selected 18 representative ones for which the secular traces were constructed as shown on accompanying Plates B and C. The diagrams are all on the same scale, viz, one centimetre to the meridional degree and the plane of representation is that plane which is tangent at the point on the spherical surface where it is intersected by the average direction of the magnetic needle, as produced. The radius of curvature of the parallels is given by the convergence of the meridians, the length of a degree on any parallel being equal to a meridional degree times the cosine of the dip.

Notwithstanding the identity of the scale of representation the secular traces appear under several distinct aspects. All the stations of Group I (eastern part of the United States) agree in the direction of the motion, viz, from left to right or clockwise, which is supposed to be the normal direction for the whole globe, and they all have a general likeness or resemblance to our most complete trace, namely, that for Cambridge. The few stations of the central group also conform to this type with an apparent broadening of the trace, as at St. Louis and New Orleans. In the third or western group we meet with apparently abnormal traces. Thus at San Francisco, Sitka, Unalaska, and probably also at Cape Disappointment the direction of the motion is apparently inverted; whether this be a real exception to the general rule time only can reveal. Irregularities such as are exhibited at San Diego and probably also at Sitka may prepare us to admit the existence of small loops obscuring the general law of clockwise motion. At Petropavlovsk we have a type common at stations on the Eastern Continent, also in the Southern Hemisphere, which approximates more toward a circular trace; the same type may also be noted at Acapulco, Mexico, the only one of our American stations showing it well developed.

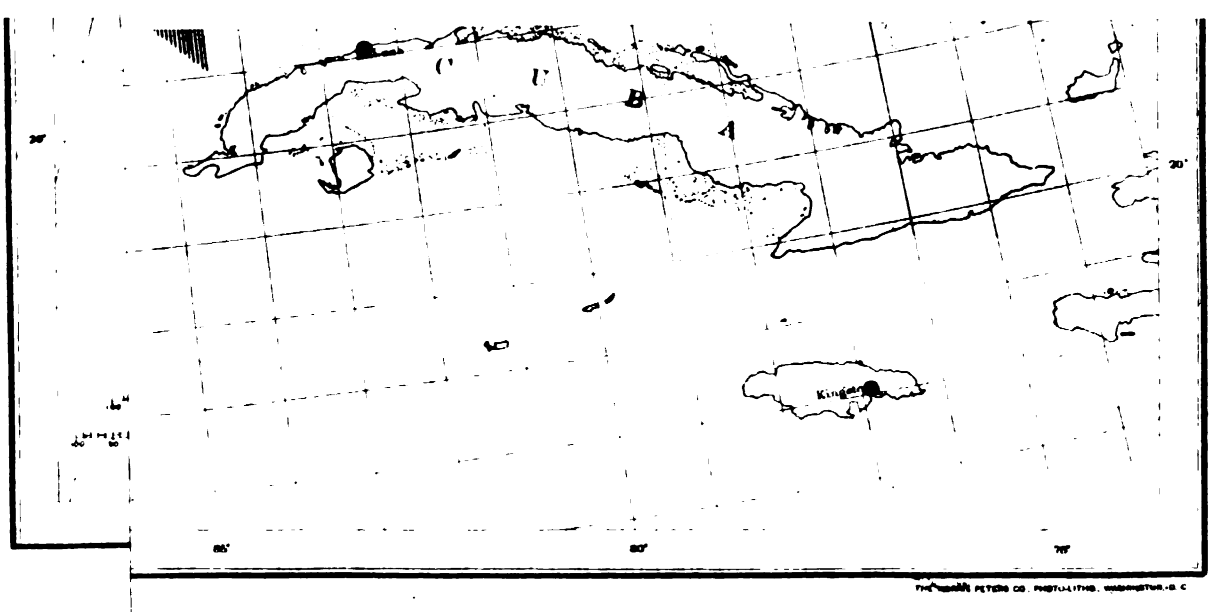
It would be rather presumptuous at this time to attempt a closer scrutiny of these secular traces. They are yet far too limited in extent and in some cases even doubtfully developed, yet they invite further research by opening new lines for investigation.

Respecting the secular variation of the total intensity (F) it is entirely too early to inquire with any advantage into the circumstances of the case, but it may be mentioned that for the Cambridge trace a maximum value of the intensity occurs within the lower apsis.

Certain results of the investigation of the secular variation laid down on the accompanying chart, already referred to, are self-explanatory. With reference to the agonic lines it may be remarked that the conjectural position for the year 1500 falls outside of the limits of the chart; the agonic for the year 1600, though ill defined, yet must have passed across Mexico or near to it, according to the preliminary isogonic charts constructed for 1580 and 1610 by W. van Bemmelen, "De Isogonen in de XVIde en XVIIde Eeuw, Utrecht, 1893," and the chart showing the isogonic lines for the epoch of the Arcano del Mare, Florence, 1646, as given in Appendix No. 6, Coast and Geodetic Survey Report for 1888; the line for the year 1700 is taken from the discussion in the preceding edition of this paper, corrected so as to pass through Charleston, S. C.,* and extended seaward according to Halley; the position for the year 1800, when the agonic line had attained its highest northeasterly position on the Atlantic Coast, is taken from the same paper. If the motion during the present century continues we may expect to see the agonic line enter Florida and possibly retrace its course across the peninsula.

COMPUTING DIVISION, *March 7, 1896.*

*At this place the compass needle pointed due north about the years 1700 and 1888; during the interval of 188 years the declination was east, or the agonic line remained to the north of the place.


C
U
B
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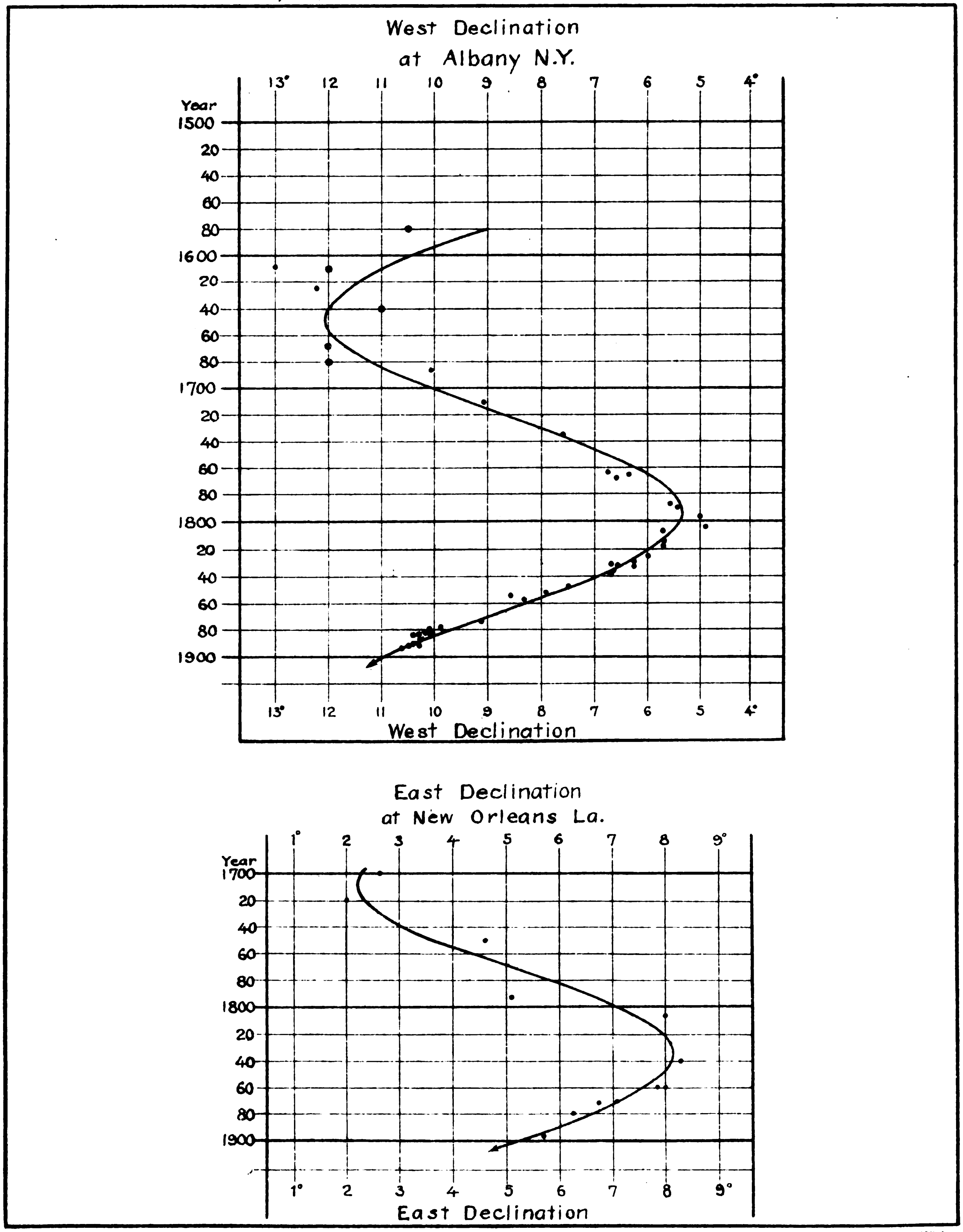
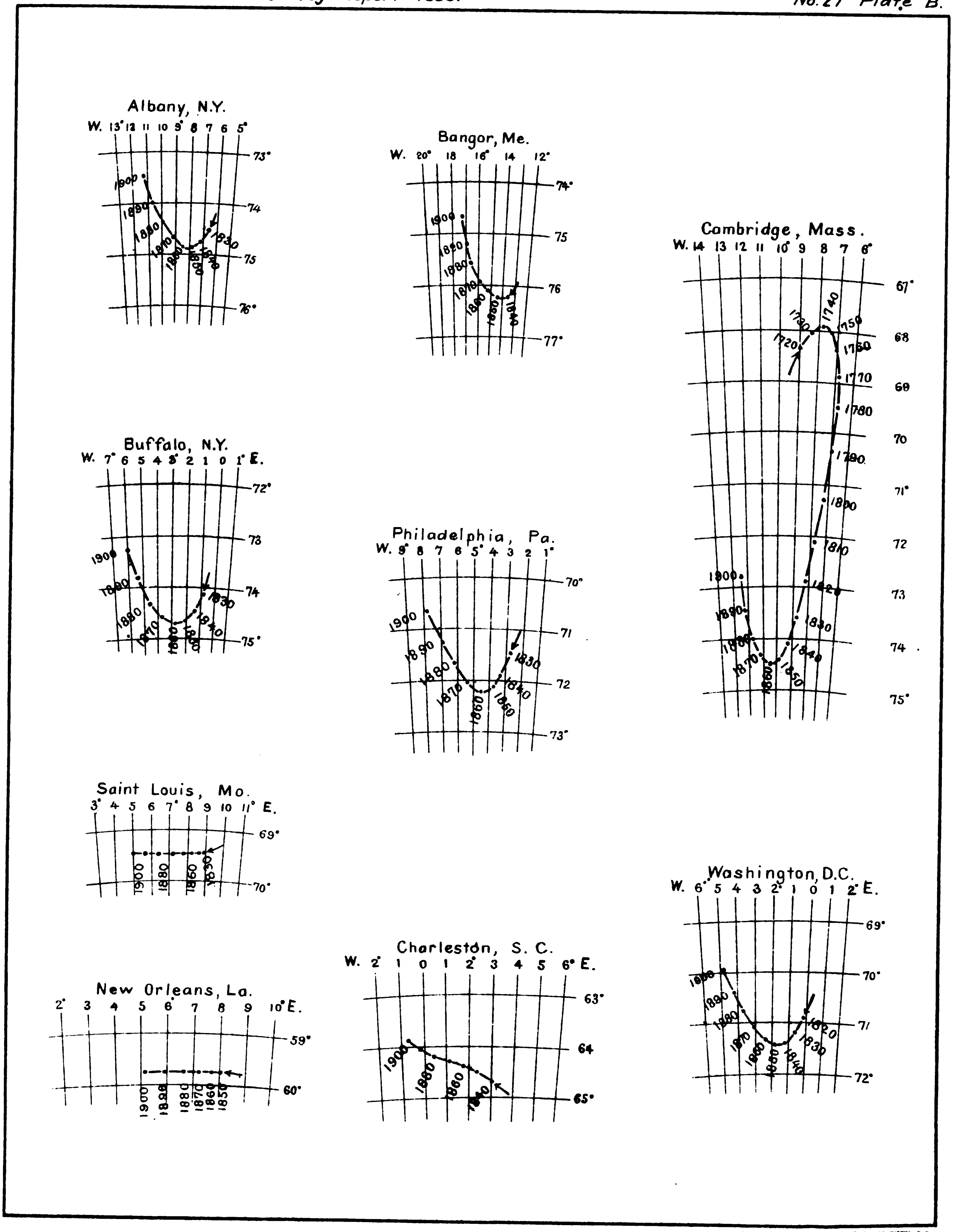
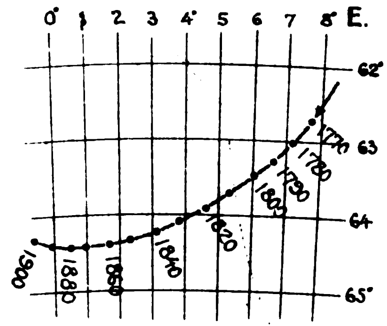
20°
85°
80°
75°


West Declination
at Albany N.Y.
Year
1500
1600
1700
1800
1900
13° 12 11 10 9 8 7 6 5 4°
West Declination
East Declination
at New Orleans La.
Year
1700
1800
1900
1° 2 3 4 5 6 7 8 9°
East Declination

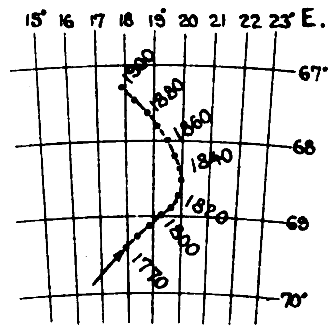


THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

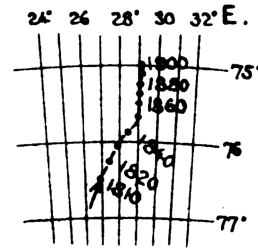
Petropavlovsk, Kamt



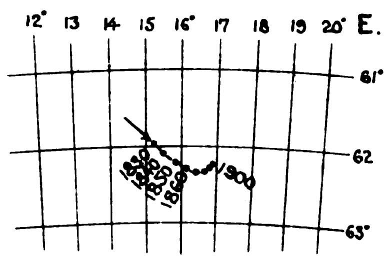
Iliuliuk, Unalaska.



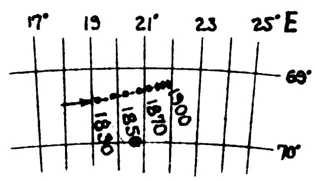
Sitka, Alaska



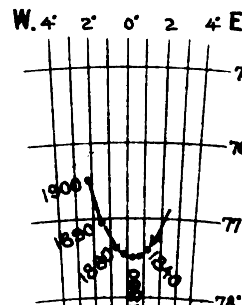
San Francisco, California



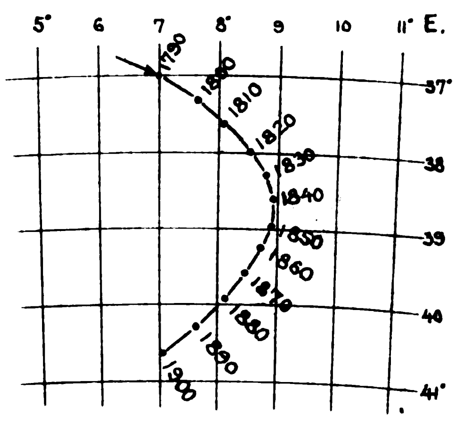
Cape Disappointment, Wash.



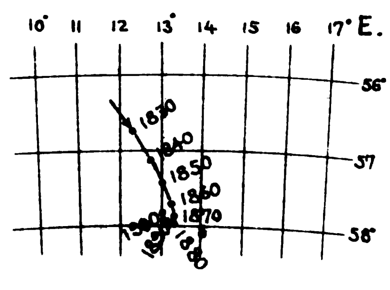
Sault de Ste. Marie, Mich.



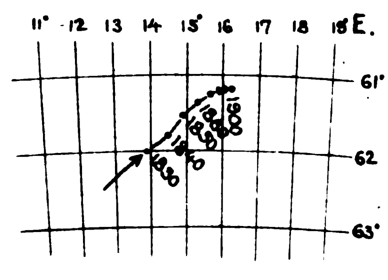
Acapulco, Mexico.



San Diego, Cal.



Monterey, Cal.



APPENDIX No. 2—1895.

ABSTRACT OF RESULTING LATITUDES OF SOME PROMINENT STATIONS IN ALASKA AND ADJACENT PARTS, AS ASTRONOMICALLY DETERMINED DURING 1889-1895.

Reported by C. A. SCHOTT, Assistant.

1. CAMP DAVIDSON, YUKON RIVER.

(J. E. McGrath, observer. November, 1889, and April and May, 1891.)

The station is located on the right bank of the Yukon River a few miles above its intersection with the boundary, and is identical with one previously established by the Canadian surveyor, W. Ogilvie.

The observations of 1889 were made with meridian telescope No. 16; value of one division of level 1″·86 and of one turn of micrometer 67″·50 as determined from observations of Polaris at eastern elongation on October 10. In the absence of a computation by the observer the office computation by H. F. Flynn was carefully scrutinized. The mean places of stars are due to H. Farquhar; the apparent places were computed independently by C. H. Kummell and J. Pawling. Twenty-one pairs of stars were observed and the average number of observations of each is less than 3. The measures are comparatively rough, yet of sufficient accuracy for the purpose intended. Probable error of a single observation ±1″·3 and of final result ±0″·3 The individual values are as follows:

No. of pairs of stars.	Stars from B. A. C.			*n*.	Weight.	Latitude.		
						°	′	″
1	7621	and	7658	2	1·1	64	40	51·89
2	7686		7778	1	·6			52·57
3	7799		7896	1	·6			51·93
4	7967		8068	2	1·2			52·45
5	8124		8162	3	1·8			48·37
6	8188		8204	3	1·8			51·04
7	8238		8252	2	1·2			47·88
8	86		180	2	1·2			51·80
9	219		320	3	1·8			50·93
10	416		438	4	2·4			51·22
11	605		705	3	1·7			52·67
12	863		955	4	2·4			48·22
13	1062		1137	3	1·8			52·85
14	1211		1282	3	1·7			49·94
15	1382		1428	3	1·8			50·54
16	1448		1477	3	1·8			48·21
17	2083		2107	1	·6			56·13
18	2223		2157	3	1·8			52·01
19	2410		6650	4	2·4			50·95
20	2722		2792	4	2·3			53·80
21	7124		2937	3	1·8			52·34
				57		64	40	51·09

Weighted mean 64° 40′ 51″·08 ± 0″·28

The observations of 1891 were made with an 8-inch (20 cm.) Gambey vertical circle No. 57, with 4 verniers reading to the nearest 5″. Polaris was observed direct and reflected in mercury, and altogether 116 sets were obtained in 10 nights, as shown in the following table of results as computed by Mr. D. L. Hazard:

Date.	No. of sets circle R.	No. of sets circle L.	Mean latitude from sets with— Circle R.	Mean latitude from sets with— Circle L.	R — L.	Mean latitude ϕ	Δ
1891.			″	″	″	° ′ ″	″
Apr. 4	11	0	59·2	....	....	64 40 57·4	—4·8
" 5	10	0	57·9	....	....	56·2	—3·6
" 25	6	6	56·7	49·7	+7·0	53·2	—0·6
May 1	6	6	54·7	50·8	+3·9	52·8	—0·2
" 2	6	6	53·9	47·9	+6·0	50·9	+1·7
" 3	6	6	55·5	49·6	+5·9	52·6	0·0
" 4	6	6	53·7	49·5	+4·2	51·6	+1·0
" 5	6	6	52·0	54·5	—2·5	53·2	—0·6
" 7	6	6	53·2	50·2	+3·0	51·7	+0·9
" 9	5	6	50·7	50·2	+0·5	50·4	+2·2
			Weighted mean		+3·5	64 40 52·6	±0·5

Resulting latitude:

From observations of Polaris with vertical circle 64° 40′ 52″·6 ±0″·5

From micrometric differences of stars N. and S. of zenith by meridian telescope 51″·1 ±0″·3

Weighted mean $\varphi = 64° \ 40' \ 51''·5 \pm 0''·3$

For the 4th and 5th of April the results are reduced to mean of Circle R and L by application of half of the mean difference 3″·5 with weight ½ to each result.

2. CAMP COLONNA, PORCUPINE RIVER.

(J. H. Turner, observer. March and April, 1890.)

The station is located on the north bank of the Porcupine River, a short distance above its intersection with the boundary, and at an elevation of 98 feet above the river.

The observations were made with meridian telescope No. 13. Focal length 66 cm., aperture 5·3 cm., magnifying power with diagonal eyepiece about 72. One division of latitude level was found to equal 2″·36±0″·01, as determined by Subassistant Turner at Camp Colonna, October 30, 1889, at the temperature —10°·9 C. The value of one turn of the micrometer was found from observations of α Ursæ Minoris at eastern elongation, 1890, July 5, 6, 8, viz: 77″·609±0″·007, the separate results being very consistent. Local time was obtained by means of the same instrument and kept by sidereal chronometer Hutton No. 223.

What we have of field computation is by the observer who brought out only a few latitude results; the office computation is by Mr. H. F. Flynn aided by two computers for the apparent places of stars. The mean places are due to Mr. H. Farquhar.

Numbers of pairs of stars observed 24, average number of observations upon a pair 4; the probable error of an observation for latitude is $e_0 = \pm 1''·03$, a very large value,* and it is supposed due to the difficulty of operating at very low temperatures. The micrometer, as well as the level values, as given above, were found to satisfy the latitude work very well. The probable error of the resulting latitude is but ±0″·14.

* On account of which the probable error of a star's place (in declination) could not be made out.

Recapitulation of results for latitude, Camp Colonna, Porcupine River, Alaska.

Pairs of stars. B. A. C.			n.	w.*	Latitude.			Δ.
					°	′	″	″
2819	and	2852	3	2·6	67	25	05·59	−0·48
2943		3049	1	0·9			03·90	+1·21
3087		3099	3	2·6			04·37	+0·74
7493		3366	3	2·4			05·83	−0·72
3496		3514	2	1·7			04·25	+0·86
3531		3645	2	1·7			04·52	+0·59
8026		3856	4	2·8			05·03	+0·08
3864		3914	5	4·0			02·79	+2·32
4033		[1028]	6	3·8			05·09	+0·02
4143		4216	6	4·4			04·70	+0·41
154		[1076]	4	2·9			06·35	−1·24
†{262		4433	5	4·0			05·43	−0·32
262		4467	4	2·7			03·82	+1·29
4484		4527}†	4	3·2			05·87	−0·76
4493		4527	1	0·9			06·21	−1·10
4540		4614	5	3·6			04·70	+0·41
4696		4732	5	3·8			05·35	−0·24
777		4864	4	3·2			04·94	+0·17
908		4961	5	3·2			05·87	−0·76
5079		[1270]	4	2·7			03·37	+1·74
5122		1061}†	5	4·2			05·27	−0·16
5130		1061	5	4·0			05·86	−0·75
5348		5462	5	4·0			06·57	−1·46
5502		5592	5	3·3			06·16	−1·05
				Indiscriminate mean	67	25	05·11	
				Weighted mean	67	25	05·11	±0·14

* For probable error of a star's place the value ± 0″·2 was used in the computation for the weight w.
† N. B.—For the combination, two-thirds of the tabular weights are to be used.

3. ST. MICHAEL.

(J. H. Turner, observer. March, April, and May, 1891.)

The observatory was located east of the main administration building, about 40 feet distant, and at an elevation of 16 feet above mean high-water level. In the vicinity of the observatory was the post flagstaff.

The observations were made with meridian telescope No. 13. For instrumental constants see report on the latitude of Camp Colonna, Porcupine River, by the same instrument and observer. The level value, as determined on October 13, 1890, was 1 div.=2″·676±0″·016 at 5° C. It is considerably different from the one determined at the camp, and it is probable that a different level vial was used, particularly since the latitude results agree with the 1890 value. There is no satisfactory determination of the micrometer value at this station, hence the Camp Colonna value (77″·609) had to be used in the first instance. It was afterwards corrected from the latitude observations themselves and found to be, 1 turn=77″·717. The chronometer correction was given by the observer.

The observer left but few computed results. The office computation was made by Mr. H. F. Flynn. The mean places of stars had been previously made out by Mr. H. Farquhar and the apparent places were computed by Mr. Kummell and Mr. Pawling. Number of observations, 106; of pairs, 27; of nights, 7. Probable error of an observation for latitude $e_0=\pm0''·90$ and of final result $\pm0''·09$.

Recapitulation of results for latitude at St. Michael, Alaska.

Pairs of stars. B. A. C.			n	w	Latitude.	Δ
					° ′ ″	″
{ 7005	and	2789*	2	0·59	63 28 42·07	—0·56
{ 7005		2833*	3	0·88	41·87	— ·36
2852		2892	2	0·60	41·42	+ ·09
2909		2930	3	0·85	41·41	+ ·10
7299		3133	4	1·15	41·02	+ ·49
7438		3246	4	1·14	42·30	— ·79
3283		3358	5	1·41	41·09	+ ·42
3402		3514	5	1·37	40·93	+ ·58
3612		3645*	4	1·14	41·63	— ·12
3645		3664*	4	1·14	41·26	+ ·25
3864		3918	4	1·16	41·73	— ·22
3990		8314	4	1·15	42·39	— ·88
[1028]		4148	4	1·09	40·81	+ ·70
4195		154	4	1·19	42·80	—1·29
4346		[2006]	4	0·93	41·61	— ·10
393		4513*	3	0·72	40·92	+ ·59
393		4526*	5	0·83	41·13	+ ·38
[1147]		4568	6	1·67	41·09	+ ·42
[1167]		4696	6	1·69	41·18	+ ·33
4949		4967*	4	1·18	42·13	— ·62
4967		4989*	4	0·99	43·24	—1·73
[1270]		5147	4	1·11	41·03	+ ·48
[1211]		5302	3	0·88	41·56	— ·05
5348		5406	3	0·89	41·98	— ·47
5574		[2388]*	4	0·32	39·73	+1·78
5575		[2388]*	4	0·32	39·21	+2·30
5705		5776	4	1·00	41·03	+ ·48
				Weighted mean latitude	63 28 41·51	±0·09

* Two-thirds of tabular weights used.

4. SITKA.

(F. Morse, observer. May and June, 1892.)

The observatory was located between the Presbyterian Church and the governor's residence, upon an outcropping ledge. It is 1″·06 north of the station of 1867–1869 upon the parade ground.

The observations were made with the Würdemann meridian telescope No. 1. For design of this instrument see Appendix No. 8, Report for 1867. Aperture 7 cm. (2¾ inches), focal distance 0·79 m. (31 inches), magnifying power about 60. The value of one division of the latitude level is stated in the record as 0″·95, but without giving authority or reference. The latitude observations, however, do not indicate any decided change in the value. Observations for value of micrometer were made May 28, June 3 and 4 on α Ursæ Minoris about eastern elongation, with the following results: 64″·312, 64″·352, 64″·334 mean = 64″·333 and when corrected for refraction 64″·307. The inequality of the screw was also investigated for whole turns and for fractional parts and corrections were applied accordingly.

The field computation was made by the observer, the office computation by Mr. H. Farquhar.

Number of pairs of stars observed 19, number of observations used 65; probable error of an observation for latitude $e_0 = \pm\ 0''\!\cdot\!74$; the probable error of a star's place could not be deduced in consequence of the large value of e_0.

Recapitulation of results for latitude of Sitka, Alaska.

Pairs of stars C. & G. S. Cat.			n	w	Latitude.			Δ
					°	′	″	″
1213	and	1233	2	0·9	57	02	53·44	—0·52
1234		1237	2	.6			52·36	+ ·56
1246		1249	3	1·1			53·92	—1·00
1258		1259	4	1·6			52·60	+ ·32
1274		1293	3	1·3			52·91	+ ·01
1318		1319	4	1·7			53·87	— ·95
1328		1336	4	1·7			53·99	—1·07
1338		1343	4	1·5			52·93	— ·01
1348		1361	4	1·6			52·89	+ ·03
1377		1382	4	1·6			52·80	+ ·12
1384		1392	4	1·7			52·66	+ ·26
1407		1420	4	1·4			52·15	+ ·77
1423		1439	4	1·6			52·76	+ ·16
1456		1466	3	1·2			52·90	+ ·02
1470		1475	4	1·8			52·68	+ ·24
1503		1511	3	1·3			52·53	+ ·39
1518		1539	3	1·3			52·90	+ ·02
1562		1594	3	·9			52·23	+ ·69
1575		1594	3	·9			53·00	— ·08
				Mean	57	02	52·92	
				Weighted mean	57	02	52·94	±0·08

5. FORT WRANGELL.

(G. R. Putnam, observer. May and June, 1893.)

The station is located on the southern edge of the United States reservation at Fort Wrangell, about 15 feet from the high-water line and 10 feet above the highest water, on the northern shore of Etolin Harbor. It was located as nearly as possible on the site of the station of 1882 and not far from the station of 1869. It is marked by a brick pier 26 by 17 inches with a granite capstone 4 inches thick. The pier stands about 40 inches above ground and the reference mark is a hole drilled in the center of the capstone. This point is also the longitude station of 1893.

The observations were made with the Würdemann meridian telescope No. 13. Focal length 66 cm. (26 inches), aperture 5·3 cm. (2⅛ inches), magnifying power about 72 with diagonal eyepiece. The level values were determined at Fort Wrangell by the observer June 14, 1893, viz, 1 div. of striding level$=1''\cdot752$ and of latitude level $2''\cdot574$, temperature 14°·0 C. Two sets of observations for value of micrometer were made, viz:

May 23, 1893.	α Urs. Min. about E. elong.	1 turn $= 77''\cdot702$	$t=$ 8° C.
June 5, "	" " " " " "	1 " $= 77''\cdot748$	$t=$ 10° C.

The latitude observations themselves demanded $77''\cdot756$.

Time was observed with the same instrument and kept by sidereal chronometer Negus No. 1771.

The field computation is by the observer, the office computation by Mr. H. Farquhar. The number of pairs of stars observed was 26 and of observations 69; the probable error of an observation for latitude $e_0=\pm0''\cdot38$, and the probable error of a star's place (in declination) $e_{\frac{**}{2}}=\pm0''\cdot35$; both are satisfactory values. With a few exceptions the stars are from the Greenwich 10-year catalogue, 1889.

Recapitulation of results for latitude at Fort Wrangell, southeast Alaska.

Pairs of stars.	B. A. C.	n	w	Latitude.	Δ
				° ′ ″	
[1147]	and 4596	2	9	56 28 17.30	
[1147]	4699	2	8	16·48	
4725	**G. 2125	2	6	16·11	
4726	**G. 2125	2	6	15·98	
4742	**G. 2125	2	6	16·00	
784	4849	2	9	16·00	
4897	4936	1	7	16·33	
4958	4978	2	10	16·92	
5079	*5168	3	8	15·97	
5094	*5168	3	8	15·88	
[1301]	5287	3	9	16·01	Max.
5343	5336	3	11	17·39	—0·93
5385	5462	3	11	15·72	
5411	5511	3	11	16·92	
G. 2351	5560	3	10	16·98	
*5599	5643	3	9	17·01	
*5599	5752	3	8	17·03	
5763	G. 2419	3	11	16·80	
*5811	5847	3	9	16·75	
*5811	5886	3	9	16·81	
50+2412	5978	3	10	16·89	Min.
**[1483]	G. 2473	3	4	14·24	+2·22
**[1483]	6062	3	6	15·23	
**[1483]	6068	3	5	15·07	
*6114	[1529]	3	9	16·19	
*6114	[1523]	3	8	16·94	
		Weighted mean		56 28 16·46	±0″·09

6. TAKU INLET.

(O. B. French, observer. May, June, and July, 1893.)

The station was located on the north end of the north island in the group of three, on the southeast side of Taku Inlet. It is on the highest point about 25 feet above high tide. The instrument was mounted upon a brick pier, built upon a foundation of solid clay and capped by a rectangular granite stone (1½ by 2 feet and 4 inches thick).

The observations were made with meridian telescope No. 9, one of the small instruments. It has a focal length of 65 cm. (25½ inches), aperture 5·2 cm. (2 inches), magnifying power 43 diameters. The glass diaphragm has 5 equidistant lines, the central one with 4 side lines and the second and fourth with 2 side lines. The value of the level was found to be 1 div. =1″·81 at 9°·8 C. from observations made by E. G. Fischer at the Survey Office, March 18, 1893. After May 25 the numbering of the level was changed from "center" to "end to end." Observations were made for value of the new micrometer on July 8, 1893, on δ Ursæ Min. about upper culmination and on α Ursæ Min. about eastern elongation, whence the values: 1 turn =80″·574 from δ Ursæ Min. and 80″·574 from α Ursæ Min., but notwithstanding this perfect accord and the certainty of the value, the latitude observations themselves unmistakably demand a higher value, viz, 80″·701. This anomaly is supposed to be due to shifting (readjusting) of focus. Time was obtained with the same instrument and kept by sidereal chronometer Hutton No. 202.

Owing to the unfavorable state of the weather the observations extend over a long period. The stars were taken, for the most part, from the last Greenwich 10-year catalogue and the observations were spread over unusually large zenith distances,* there being several pairs with $\zeta = 56°$. It would appear that there is no specific difference in the results for φ depending on ζ and the observer's supposition of different refractions for the north and south stars is not justified by the very limited experience. Number of pairs of stars observed 33, of observations 107; probable

* Northern stars with $\zeta > 31° 34'$ are sub polo.

error of an observation for latitude $e_0 = \pm 0''\cdot55$ (a fair value for this size of instrument) and probable error of a star's place in declination $= \pm\ 0''\cdot38$.

In the following table of results the relative weights depend on the number of observations on a pair and upon the probable error of the star places; doublets have special weights. The probable error of the result is as small as that of any first-class latitude.

Recapitulation of results for latitude at Taku, Alaska.

Pairs of stars from B. A. C.		ζ	n	w	Latitude with obs'd mic. value.			With corr'd value.	Δ
		°			°	′	″	″	″
990 and	5047	56	2	6	58	26	15·60	15·51	+0·11
1001	5095	56	2	6			16·25	16·04	−0·42
5147	[1289]	6	3	7			15·86	15·54	+0·08
1137	5214	51	3	8			15·11	15·65	−0·03
1211	5367*	41	2	4			16·10	15·95	−0·33
5367*	1276	41	2	4			14·93	15·25	+0·37
G. 2326	5461	9	3	6			14·80	15·28	+0·34
5496	5592	21	3	8			15·14	15·28	+0·34
1428	5587	46	3	8			15·42	15·48	+0·14
5617	5705	19	3	9			15·00	15·16	+0·46
1510	5802	48	5	11			17·09	17·29	−1·67
1549	5841	48	5	13			17·01	16·18	−0·56
5919	1751*	56	5	8			16·75	15·94	−0·32
1751*	6020	56	5	8			16·52	15·87	−0·25
6062	6114*	18	5	9			15·92	15·63	−0·01
6068	6114*	18	5	9			16·11	15·75	−0·13
6147	6281	28	5	13			15·90	15·10	+0·52
6320	6237	29	5	11			15·21	15·43	+0·19
6268	6375*	19	2	4			16·52	16·42	−0·80
6375*	G. 2644	19	2	4			14·82	15·45	+0·17
6404	6478*	17	2	4			14·92	15·61	+0·01
6478	6473	17	3	6			15·49	15·79	−0·17
6493	6563	18	2	6			16·32	14·76	+0·86
Ll. 36249	6612	9	3	9			15·58	14·87	+0·75
6662	6697	7	3	9			15·72	15·34	+0·28
6744	2521	41	3	9			15·59	16·11	−0·49
6808	6830	11	3	8			15·14	15·56	+0·06
6856	6905	6	3	9			15·06	15·63	−0·01
7005	7022	19	3	9			17·56	16·36	−0·74
7073	7178	22	3	9			16·42	15·64	−0·02
7230	7204	25	3	8			14·98	15·14	+0·48
7255	3087*	54	3	5			14·94	15·10	+0·52
7276	3087*	54	3	6			14·44	15·28	+0·34
		Means			58	26	15·70	15·62	
		Weighted mean			58	26		15·64	±0·06

7. BURROUGHS BAY.

(W. H. Edmonds, observer. July, August, and September, 1893.)

The station is located near the head of Burroughs Bay, on a slight knoll on the hillside, about 70 feet above the wharves of the Burroughs Bay Cannery building and about 100 feet above mean low water, in a spot quite clear of the surrounding forest. The station is marked by a brick pier, set in cement and furnished with a stone cap. It rests upon solid rock.

The observations were made with meridian telescope No. 7. It was changed in 1870–71 from a transit into a time and latitude instrument. Focal length 66 cm., aperture 5·4 cm., magnifying power with diagonal eyepiece 67; it is supplied with a glass diaphragm. Value of striding level* 1 div.$=2''\cdot04$ from observations by E. G. Fischer, November 3, 1890, and of latitude level 1 div.$=2''\cdot30$. The value of the micrometer was determined from observations of Polaris about

* The observer mistook this for the latitude level.

eastern elongation on August 16, 1893, viz, 1 turn$=78''\cdot287$; this is in accord with previous values by other observers. Time was obtained with the same instrument and kept by sidereal chronometer Hutton No. 223.

The observations extend over a long time and are irregularly scattered and unequal in number of nights for the pairs of stars in consequence of the cloudy state of the sky. Between May and July 20 no latitude work was possible, and not till the middle of August was a fair night available, though clouds were present at all dates. Number of pairs of stars observed 42, number of observations 191 (of which 3 were rejected); probable error of an observation for latitude $e_0=\pm0\cdot61$ (an ordinary value with this instrument), and of a star's place in declination $e_{\frac{**}{2}}=\pm0''\cdot63$, a somewhat doubtful value.

In the following table of results the relative weights depend on the number of observations of the pair and upon the probable errors of the star places; doublets have special weights.

Recapitulation of results for latitude at Burroughs Bay, Alaska.

Pairs of stars from— C. & G. S. Cat.		B. A. Cat.		n	w	Latitude.	Δ.
						° ′ ″	″
1493 and	1498	6047 and	6068	1	8	56 02 09·68	+1·87
1530	1548	6162	6243	1	8	07·71	+3·84
1556	1560	6268	6302	1	8	11·35	+0·20
1566	1580	6348	6395	2	11	10·85	+0·70
	1601	6419	6463	3	12	10·24	+1·31
1623	1628		6520	4	12	10·86	+0·69
1646	1664	6581	6650	4	13	11·44	+0·11
1694	1702	6735	6745	4	13	11·38	+0·17
1728	1741	6824	6852	6	14	11·39	+0·16
1765		6912	6999*	1	8	11·78	−0·23
	1785	6999*	6968	1	8	12·26	−0·71
1793	1796	7005	6998	5	13	11·13	+0·42
1806	1813		7085	7	13	12·18	−0·63
1820		7094	2930	6	13	14·60	−3·05
1852	1862	7211	7233	6	14	10·99	+0·56
1877	1899	7277	7363	7	14	12·21	−0·66
	1907	7381	7399	6	14	11·64	−0·09
1903	1931	7377	7468	2	11	11·05	+0·50
1932	1940	7465	7510	6	13	10·76	+0·79
1948	1954	7542	7560	7	14	10·95	+0·60
1968	1979	7598	7658	8	14	12·26	−0·71
1996	2003	7708	7746	8	14	11·01	+0·54
2016*		7789*	7825	1	8	12·31	−0·76
2016*	2038	7789*	7855	6	14	11·86	−0·31
2036	2041	7850	7876	1	8	13·72	−2·17
2043	2045	7880	7896	6	13	11·47	+0·08
2057	2073	7923	7990	7	14	12·37	−0·82
2087	2110	8023	8106	7	14	11·80	−0·25
2130	2145	8195		6	6	12·19	−0·64
2162	2167	8310	8322	6	14	10·69	+0·86
2177	6		16	6	13	11·55	0·00
15	23	46	79	6	13	11·91	−0·36
32	51	126	180	5	13	11·73	−0·18
56	61	201	218	3	12	12·91	−1·36
74	87	253		6	13	10·48	+1·07
103		339	391	5	13	12·20	−0·65
123	128	412	432	5	13	10·53	+1·02
137	156	482	558	5	13	11·88	−0·33
170	179	595	628	5	13	11·95	−0·40
1189	209	4733	745	2	11	12·69	−1·14
218	229	777	821	2	11	11·91	−0·36
241	266	863	948	2	11	11·38	+0·17
					Indiscriminate mean	56 02 11·55	
					Weighted mean	56 02 11·57	±0·10

8. ANCHORAGE POINT, CHILKAT INLET.

(J. F. Hayford, observer. June and July, 1894.)

The station is located just to the southward of Pyramid Harbor, Chilkat Inlet, and is marked by a brick pier, laid in cement, standing on a concrete bed and having a granite capstone marked U. S. C. & G. S. 1894. A copper bolt in the center of the capstone and one in the center of the concrete foundation mark the station point.

The observations were made with meridian telescope No. 9. Diameter of objective 5 cm., focal length 64 cm., magnifying power about 50. One division of latitude level = $1''\cdot81$ as determined at the office in March, 1893. The value of 1 turn of the micrometer was found from observations of Polaris near eastern elongation, July 7, 1894, viz, $80''\cdot60$ with a small inequality for parts of a turn. Observing chronometer Bond No. 380 (sidereal).

The field computation was made by the observer, the office computation by H. Farquhar. Number of pairs of stars observed 14, of nights of observation 10, and number of observations 28. Probable error of observation $e_0 = \pm 0''\cdot36$ and of a star's place (in declination) $e_{\frac{**}{2}} = \pm 0''\cdot29$.

The weights to each result for latitude are substantially uniform.

Recapitulation of results for latitude at Anchorage Point, Alaska.

Pairs of stars B. A. C.		Latitude.			Δ
		°	′	″	″
5168 and	5191	59	10	19·14	+0·30
5234	1211			18·92	+0·52
5511	5552			19·37	+0·07
5514	5596			19·16	+0·28
5574	5628			19·66	−0·22
5780	5788			18·55	+0·89
5840	5950			18·74	+0·70
5990	6048			19·58	−0·14
6281	6178			18·97	+0·47
6245	2095			19·76	−0·32
2326	6589			20·18	−0·74
6551	6662			20·48	−1·04
6623	6662			19·54	−0·10
6783	2590			20·18	−0·74
	Mean	59	10	19·44	±0·10

9. LION POINT, PORTLAND CANAL.

(P. A. Welker, observer. May, June, and July, 1895.)

The station was located near the head of Portland Canal on a prominent rocky knoll, near the extreme end of Lion Point, about 20 metres back from high-water mark and 7 metres above mean high water. The station is marked by a brick pier, capped with a granite block with the letters U. S. C. & G. S., 1895, cut into the top surface. A copper bolt set in the center of the capstone marks the station.

The observations were made with meridian telescope No. 13. Focal length 65 cm., aperture 5·2 cm., magnifying power about 55. Value of one division of latitude level = $2''\cdot23$, as determined by E. G. Fischer, March 18, 1893. Five sets of observations for value of micrometer were made, but these showed consistently that the screw was very irregular; thus the value for 1 turn = $77''\cdot783$ between turns 0 and 24, and $78''\cdot417$ between turns 24 and 30. The latitude observations demanded the values $77''\cdot697$ and $78''\cdot331$, respectively. The field computation is by the observer, aided by

Mr. O. B. French. The office reduction is by Mr. H. F. Flynn, assisted by Mr. O. H. Kummell in the reduction of apparent places of stars. Number of pairs of stars observed 19; average number of observations upon a pair 4·8; the probable error of an observation for latitude is $e_0 = \pm 0''.39$.

Recapitulation of results for latitude at Lion Point, B. C.

Pairs of stars. B. A. C.		n	w	Latitude.	Δ
				° ′ ″	″
4607 and	[1167]	5	7	55 52 52·92	+0·13
4646	[1179]	4	7	53·02	+0·03
(1498)	4845	5	4	53·88	−0·83
(1499)	4845	5	4	53·40	−0·35
4874	4937	5	7	53·48	−0·43
5022	(2477)	5	7	53·08	−0·03
5147	5177	5	7	53·22	−0·17
5259	5343	5	7	52·99	+0·06
5514	5523	4	6	53·27	−0·22
5545	5552	5	8	54·16	−1·11
5568	5628	5	7	53·39	−0·34
5705	5747	5	7	52·47	+0·58
(1742)	(2402)	4	3	53·43	−0·38
(1743)	(2402)	4	3	52·61	+0·44
5927	(544)	5	6	52·50	+0·55
[1483]	[1489]	5	6	52·70	+0·35
(3245)	6375	5	7	52·01	+1·04
6410	6470	5	6	52·66	+0·39
[1623]	6520	5	7	53·16	−0·11
	Indiscriminate mean			55 52 53·05	

Weighted mean after micrometer correction, } 55° 52′ 53″·07 ±0″·08 (adopted).

10. PORT SIMPSON.

[O. B. French, observer. May and June, 1895.)

The station is located on the west side of the hill just east of the town of Port Simpson, B. C., and is a little north of east and distant about 300 metres from the Hudson Bay Company's store. The point is marked by a brick pier about 3 feet high, capped by a granite block 17 by 24 by 4 inches, marked on its upper surface U. S. C. & G. S. 1895.

The observations were made with meridian telescope No. 9. Focal length 65 cm., aperture 5·2 cm., magnifying power 43 diameters. Value of 1 division of latitude level = 1″·81 as determined by E. G. Fischer, at the office, March 18, 1893. The value of the new micrometer screw, supplied in the spring of 1893, was found as follows:

Date.	Star.	Position.	Value of one turn.
1895.			″
May 30.	δ Urs. Min.	U. C.	80·662
May 30.	λ Urs. Min.	U. C.	·677
June 25.	β Urs. Min.	W. E.	·666
June 25.	α Urs. Min.	E. E.	·695

Mean value 80″·675 adopted. The observations prove the screw to be fairly regular. A set of observations on June 13 was rejected by the observer on account of imperfect focus.

Time observations were made with meridian telescope No. 2, and sidereal chronometer Frodsham No. 3462 was used.

The field computation is by O. B. French, the office reduction by H. F. Flynn. Number of pairs of stars observed 21, number of observations for latitude 76. The probable error of an observation for latitude $e_0 = \pm 0''.46$, and probable error of a star's place (in declination) $= \pm 0''.13$, an extremely small value. The estimated a priori value of the mean place was $\pm 0''.17$.

Recapitulation of results for latitude at Port Simpson, B. C.

Pairs of stars. B. A. C.		n	w	Latitude.			Δ
				°	′	″	″
4276 and	4287	1	4	54	33	33.43	+0.90
[1086]	4342	1	4			33.53	+ .80
4350	4392	1	4			33.82	+ .51
(720)	4451	1	3			33.77	+ .56
(720)	(2400)	1	3			34.11	+ .22
4540	4555	4	12			34.40	— .07
4568	4649	5	15			34.25	+ .08
4696	4699	5	17			34.06	+ .27
4732	4758	3	10			34.28	+ .05
(777)	4870	4	13			34.31	+ .02
4907	4918	4	13			33.46	+ .87
4967	4980	4	15			34.40	— .07
5079	(2651)	4	14			34.01	+ .32
5094	(2653)	4	15			34.45	— .12
[1288]	[1293]	4	8			34.21	+ .12
5237	5244	5	13			34.72	— .39
5316	5348	5	16			34.65	— .32
5459	5461	5	10			33.66	+ .67
(1669)	5535	5	9			34.52	— .19
5611	5604	5	15			35.26	— .93
5705	5731	5	17			34.89	— .56
	Indiscriminate mean			54	33	34.20	
	Weighted mean			54	33	34.33	±0.07

which last value is proposed for adoption. This value supersedes the older determination by a hydrographic party and the results given in the Coast Pilots of Alaska.

11. MARY ISLAND.

(E. F. Dickins, observer. June and July, 1895.)

The station is located S. 40° W. by compass, and distant 69.2 feet from the west corner of the United States custom-house. It is marked by a brick pier with its base about 3 feet below the surface of the ground and surmounted by a granite capstone marked U. S. C. & G. S. 1895.

The observations were made with meridian telescope No. 1. Value of 1 division of level $1''.90$, as determined at the office; 1 turn of micrometer$=65''.962$, as determined on 3 nights from observations of Polaris about western elongation. Time was obtained in connection with the longitude work.

The office computation was made by H. F. Flynn and revised by L. Pike. The star places were determined with the usual care, but the observing error (due to unfavorable circumstances) is large and did not permit the probable error of a star's place to be deduced from the observations. The weights to the individual results will depend therefore simply on the number of observations. The probable error of an observation for latitude is $\pm 0''.95$.

Recapitulation of results for latitude, Mary Island, Alaska.

Pairs of stars. B. A. C.			n	w	Latitude.			Δ
					°	′	″	″
5033	and	5058	2	2·0	55	05	32·50	+0·70
5079		5084	2	2·0			33·10	+0·10
5098		5205	3	3·0			34·94	−1·74
5237		5302	1	1·0			31·65	+1·55
5343		5432*	2	1·3			33·42	−0·22
5432*		5462	6	4·0			32·15	+1·05
5479		5511	7	7·0			33·77	−0·57
5541		5592	4	4·0			32·55	+0·65
5568		5601*	6	4·0			34·18	−0·98
5601*		5706	7	4·7			32·96	+0·24
5785		5801	5	5·0			34·15	−0·95
5853		5917	3	3·0			31·39	+1·85
5950**		5950**	6	3·0			32·33	+0·87
5978		6056	6	6·0			32·65	+0·55
6114		[1513]	7	7·0			32·86	+0·34
6147		6206	7	7·0			32·53	+0·67
[1536]		6243	5	5·0			33·50	−0·30
6258		6289	1	1·0			33·02	+0·18
6368**		6368**	1	0·5			33·26	−0·06
6395		[1590]	5	5·0			34·67	−1·47
6419		6477*	4	2·7			33·88	−0·68
6452		6477*	4	2·7			34·26	−1·06
6500		6530	4	4·0			32·77	+0·43
6551		6583*	4	2·7			33·78	−0·58
6583*		6623	4	2·7			33·65	−0·45
				Mean	55	05	33·20	

	°	′	″	″
Weighted mean	55	05	33·22	±0·12
Reduction to station "Custom"				+0·22
Latitude of station "Custom"	55	05	33·44	±0·12

APPENDIX No. 3—1895.

ABSTRACT OF RESULTING LONGITUDES OF SOME PROMINENT STATIONS IN ALASKA AND ADJACENT PARTS, AS ASTRONOMICALLY DETERMINED DURING 1889-1895.

Reported by C. A. SCHOTT, Assistant.

1. CAMP DAVIDSON, YUKON RIVER.

(J. E. McGrath, observer. 1889-1891.)

[For description of station and instrument see report on the latitude observations.]

The observations for longitude comprise 2 occultations in January, 1891; a transit of Mercury, May, 1891; a solar eclipse, June, 1891; and a series of moon culminations between November, 1889, and April, 1891. The occultations and the eclipse were computed by myself and checked by D. L. Hazard, since no computation had been made by the observer. The moon culminations were reduced by D. L. Hazard and checked as far as required. The corrections to the lunar ephemerides were taken from the Greenwich observations, and corresponding observations made at San Francisco, Cal., in connection with the moon culminations were utilized. Transits of Mercury are phenomena not favorable for exact longitude determinations, and as but one phase (first interior contact) was observed, no use has been made of the observation nor of the 12 photographs secured while the planet was in transitu. We have for the longitude λ of Camp Davidson, Yukon River.

	h.	m.	s.	
From Immersion of 30 Piscium, Jan. 14, 1891.*	9	23	35·5	W. of Gr.
From Immersion of 33 Piscium, Jan. 14, 1891.			37·2	
From first and last contact, solar eclipse, June 6, 1891.			32·2	
Weighted mean (the last result having weight ½), with a probable error of about $\pm$ 1s.	9	23	35·5	W. of Gr.

A rough computation for longitude from moon culminations was made by the observer; the office reduction is by D. L. Hazard. The moon was observed on 23 days, on 19 of which satisfactory results were obtained. The results marked with an asterisk in the following table were obtained by comparing the Camp Davidson observations with the Greenwich ephemeris corrected by interpolation; in all other cases there were corresponding observations either at San Francisco or at Greenwich, or at both places. The weights assigned to the mean value for each day depend upon whether there were corresponding observations at one or both stations and whether one or both limbs were observed.

* On this day the temperature of the air was noted —51°·5 F. or —46°·4C.

Summary of results for longitude of Camp Davidson, Alaska, from observations of moon culminations.

$9^h\ 22^m$ + tabular quantity.

Date.	From corresponding observations— At Greenwich. ☾ I.	☾ II.	At San Francisco. ☾ I.	☾ II.	Means. ☾ I.	☾ II.	Mean referred to ½ (I & II).	Weights.
1889.	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	
Nov. 3.	[65·7]	Rejected.			Time?			
" 10.		35·7*				35·7	35·5	1·0
1890.								
Mar. 8.		40·9				40·9	40·7	1·4
" 27.	30·6*		28·9		29·8		30·0	1·8
" 28.	37·6				37·6		37·8	1·4
" 29.	42·9		44·3		43·6		43·8	2·0
" 30.	35·3		39·8		37·5		37·7	2·0
Apr. 2.	34·7				34·7		34·9	1·4
" 6.		35·7*				35·6	35·5	1·0
" 7.		40·6		43·3		42·0	41·8	2·0
Aug. 29.	32·7	32·9			32·8	32·9	32·9	2·0
" 30.		49·1				49·1	48·9	1·4
Nov. 24.	[50·3]	[57·0]	Rejected.		Time?			
" 27.		38·1*		39·4		38·8	38·6	1·8
1891.								
Jan. 24.	[59·0]	[62·3]	Rejected.	[64·9]	Time?			
Feb. 25.		[59·9]	Rejected.	[64·2]	Time?			
" 27.		30·5				30·5	30·3	1·4
" 28.		34·4*				34·4	34·2	1·0
Mar. 24.	37·3*	37·3*	37·8	38·5	37·5	37·9	37·7	2·5
" 25.	43·0*	42·1*			43·0	42·1	42·5	1·4
Apr. 20.	42·2				42·2		42·4	1·4
" 21.	36·6*	34·0*			36·6	34·0	35·3	1·4
" 23.	44·6	48·2			44·6	48·2	46·4	2·0
Means	37·9	38·4	37·7	40·4	38·2	38·6	38·3	

$\Sigma p = 30{\cdot}3$ and weighted mean $38''{\cdot}5$, hence the resulting longitude from the moon culminations $9^h\ 23^m\ 38^s{\cdot}5 \pm 0{\cdot}675 \sqrt{\frac{[pvv]}{[p]\ (n-1)}} = \pm\ 0^s{\cdot}8$, and it should be noted that the separate results from the two limbs of the moon show no decided specific difference.

COMBINATION OF THE RESULTS FOR LONGITUDE FROM OCCULTATIONS AND AN ECLIPSE, AND FROM MOON CULMINATIONS.

The probable error $\pm\ 1^s$ assigned to the former result is too weak for use in combination, hence we give the weight 2 to each occultation result and the weight 1 to the eclipse result, hence we have:

	h.	m.	s.		
λ from occultations and eclipse	9	23	35·5	weight	5
λ from moon culminations			38·5	"	30
Resulting longitude of Camp Davidson	9	23	$38{\cdot}1 \pm 0^s{\cdot}7$ or		
	140°	54′	$31''{\cdot}5 \pm 10''{\cdot}5$		

The triangulation of the Yukon River in the vicinity where it is traversed by the international boundary line will depend upon the astronomic latitude and longitude. An azimuth was observed at the camp station, "Bluff △." In the latitude of the astronomic station 1′ of the arc of parallel equals 795·7 metres, and 1″ equals 13·26 metres, hence the transit house is 4356·4 metres, equal to 2·707 statute miles, east of the one hundred and forty-first meridian.

2. CAMP COLONNA, PORCUPINE RIVER.*

(J. H. Turner, observer. 1889–1890.)

[For description of station and instrument see report on the observations for latitude.]

The longitude of this station rests wholly upon 13 moon culminations and 1 occultation. For its *approximate* location close to the boundary, the longitude of Fort Yukon, 210 miles distant, as

* Also longitude of Old Rampart house, on the Porcupine, and longitude of Fort Yukon.

determined in 1869 by Capt. C. W. Raymond, was made use of. In consequence of cloudy and foggy weather no chronometric connection was made between the two places on the ascent of the river in 1889, but it succeeded on the descent in the following year.

On October 4, 1889, meridian telescope No. 13 was mounted in the observatory, a wooden structure 10 feet square. It is in latitude 67° 25′ 05″·11 ±0″·14, and is therefore within the Arctic Circle and 52′·2 north of it.

Although the number of astronomic observations for longitude is small, owing to fog during the winter, clouds during the summer, and the continuous twilight about the beginning of May, rendering observations of stars difficult, we may conclude with the observer that sufficient data have been obtained to make the determination of the boundary satisfactory for all practical purposes. Faint stars, such as many of the moon culminations stars, could only be observed with difficulty, or not at all, and the probable error of a time determination by a single star which in middle latitudes would be nearly ±0s·04, rises to ±0s·08 within the Arctic Circle.

Corresponding observations of moon culminations were made at San Francisco, Cal., by F. Morse and J. J. Gilbert between December 28, 1889, and March 30, 1891, as proposed by Assistant G. Davidson. At this place, also, the observers compared for personal equation, both for star and moon transits, with the following results: August 14–20, 1891. Morse–Turner =+0s·06 for stars and −0s·07 for moon.

The transit observations at the camp were reduced by Assistant A. T. Mosman (temporarily assigned to the computing division), and completed and revised by Mr. D. L. Hazard. Special attention was paid to the rate of the chronometer about the time of the moon culminations, since the rate at those times was found different from the corresponding daily rate; in fact, the rates at times were excessive, due to extremely low temperatures, the minimum stated being −42°·8 C. (or −45° F.).*

The transits at San Francisco were reduced by Mr. Hazard; the moon culminations and the occultation at the camp were computed by myself and checked by Mr. Hazard. Corresponding observations of the moon were found at San Francisco, at Washington, D. C., and at Greenwich, England, but on three nights the lunar ephemeris had to be corrected from Greenwich observations made close to these dates.

Recapitulation of results for longitude at Camp Colonna, Porcupine River, Alaska, from observations of moon culminations between November, 1889, and April, 1890.

Date.	Corresponding observations at—	Longitude 9h 23m + from ☾ I.		Longitude 9h 23m + from ☾ II.	Δ (II − I).	λ = 9h 23m + from I + 9s.	λ = 9h 23m + from I & II.	Weight p	v
		s.	s.	s.	s.	s.	s.		s.
1889, Nov. 6.	Washington.	38·8	39·8	[52·8]	+14·0		45·8	½	−11·1
" 6.	Greenwich.	40·8		[54·7]	+13·9		47·8	½	− 9·1
" 9.	"	[36·4]		71·5	+35·1		54·0	1	− 2·9
" 30.	"	37·7				46·7		½	−10·2
Dec. 2.	Washington.	39·8							
" 2.	Greenwich.	38·0	38·9			47·9		½	− 9·0
" 8.	Ephemeris corrected.	[52·6]		69·0	+16·4		60·8	1	+ 3·9
" 9.	"	[45·6]		71·1	+25·5		58·4	1	+ 1·5
" 27.	Washington.	35·3							
" 27.	Greenwich.	37·7	36·5			45·5		½	−11·4
" 28.	San Francisco.	40·8							
" 28.	Washington.	44·4	42·0			51·0		½	− 5·9
" 28.	Greenwich.	42·1							
" 29.	"	52·7				61·7		½	+ 4·8
1890, Jan. 29.	"	48·0				57·0		½	+ 0·1
Mar. 2.	"	49·1				58·1		½	+ 1·2
" 7.	Ephemeris corrected.	[60·3]		67·2	+ 6·9		63·8	1	+ 6·9
Apr. 3.	San Francisco.	47·4	49·6			56·4		¼	− 0·5
" 3.	Greenwich.	51·9		[66·6]	+14·7		59·2	¾	+ 2·3
				Means	+18·1	53·0	55·7		

* March 8, 1890, the lowest temperature recorded was −44°·7 C. (or −48°·5 F.).

Where v = difference from $56^s.9$, see further on.

Values inclosed in brackets are obtained from the moon's defective (in illumination) limb, as corrected. The result of December 28 from corresponding observation at San Francisco has been given double weight on account of the known personal equation. On April 3 the observation at the camp was by H. W. Edmonds.

There is the usual systematic difference in the results from observations of ☾ I and ☾ II, only large in the present case, viz, $18^s.1$; half of this amount divided by 27 would measure the irradiation by which ☾ I is observed too early and ☾ II too late; it is one-third of a second nearly.

The results in column headed λ have slightly different weights depending on the rate of change of the moon's right ascension, for which we may take from the ephemeris the variation in one minute; in the present case the weighted means were the same as the indiscriminate tabular means;* nor was it necessary to refer to another refinement in relative weights namely, those depending on an unequal number of observed threads in the transits. The weights, marked p however, are important, since the results of the first row headed I + 9^s depend only on one-half of the number of observed transits of the moon as compared with the results in column I & II, hence the respective weights $\frac{1}{2}$ and 1; exceptions are the two days of November 6 and April 3, when the sum of the two weights must equal unity for each date.

From $\Sigma p\lambda = 526.3$ and $\Sigma p = 9.5$ we have the weighted mean value for the longitude of the observatory $9^h\ 23^m\ 55^s.4$ as far as this depends on the observed moon culminations. Forming $\Sigma pv^2 = 367.5$ and putting $n = 13$ we get the probable error of a single determination for longitude from moon culminations $0.675\sqrt{\frac{\Sigma pv^2}{n-1}} = \pm 3^s.7$, a fair value since in middle latitude $\pm 3^s$ is noted as an ordinary result.

We have next to combine with the preceding result that deduced from the occultation of η Geminorum on November 10, 1889, both immersion and emersion being observed. With a revised chronometer correction and a corrected lunar ephemeris from Greenwich observations we get the resulting longitude from the immersion $9^h\ 24^m\ 05^s.9$ and from the emersion $9^h\ 24^m\ 01^s.4$, mean $9^h\ 24^m\ 03^s.6$.†

Results from occultations being of superior value in comparison with moon culminations the weight 2 has been assigned to it in connection with tabular weights p. We then have for our *final value*, from

$\Sigma p\lambda = 653.7$ and $\Sigma p = 11.5$	$\lambda = 9^h\ 23^m\ 56^s.9$	or $140^\circ\ 59'\ 13''.5$
with a probable error, $0.675\sqrt{\frac{[pv^2]}{[p]\,(n-1)}}$	± 1.2	± 17.7

The observer's preliminary adopted longitude of the camp was $9^h\ 23^m\ 56^s$ and on his topographical map (No. 2066) he locates approximately the meridian of 141° west and marked the same on the ground 625 metres west of his observatory.

In latitude 67° 25′ 05″ one minute of longitude equals 714.5 metres and 1″ equals 11.9083 metres; the difference between $141^\circ\ 00'\ 00''.0$ and $140^\circ\ 59'\ 13''.5$ being $46''.5$, which equals 554 metres (nearly), shows that Assistant Turner's approximate boundary line is 625—554 or 71 metres farther to the west than the position resulting from the present investigation. On the scale of his map ($\frac{1}{5000}$) the boundary line should therefore be shifted to the east by 14.3 mm. (about 0.56 of an inch). The probable error of this position $\pm 17''.7$, equals ± 214 metres, or between one-seventh and one-eighth of a statute mile.

The observatory was 98 feet above the river, its altitude above the sea I estimate at 650 feet, viz: Altitude of Fort Yukon as determined by Captain Raymond, U. S. E., in 1869, 412 feet; distance of Fort Yukon from the sea 966 statute miles, slope stated 5 inches per mile. Supposing the Porcupine's slope to be 8 inches per mile, the difference in height for 210 miles equals 140 feet, hence for altitude of river at camp 552 feet and of observatory 650 feet; also its distance from the

* The extreme values of the weights being 1.94 and 2.16.

† The observer's approximate results were $9^h\ 24^m\ 07^s.2$ and $9^h\ 23^m\ 55^s.4$; that given above is from my own reduction and a check reduction by Mr. Hazard.

mouth of the Yukon 1176 statute miles. An altitude of 650 feet has but a slight effect on the computed longitude from the occultation.

The topographic survey of the region about Camp Colonna depends on triangulation with a base 953 metres in length measured on the ice; the angles were measured with an 8-inch theodolite.* The reconnoissance to the north in March and April, 1890, during which the Arctic Ocean was reached, was not productive of astronomic determinations for position in consequence of the breaking down of the two chronometers. The reconnoissance to the south intended to make a junction with the work of Assistant McGrath's party on the Yukon, engaged in locating the boundary there, failed on account of the flooded condition of the country due to the melting of the snow.

Camp Colonna was abandoned on July 15, 1890, and the party arrived at St. Michael, Alaska, on August 30, 1890, where it was forced to winter for want of transportation southward. The flying topographic survey of the Porcupine between Camp Colonna and Fort Yukon showed a fair accord with the longitude assigned to the fort by Captain Raymond in 1869,† the position assigned by him is $\varphi=66^\circ\ 33'\ 47''$ $\lambda=145^\circ\ 17'\ 47''$. The latter value depends on two moon culminations and one contact of a solar eclipse, but two other values were rejected. The position of the Old Rampart house on the Porcupine, about 33 miles down the river from the camp, was satisfactorily determined by Turner, as well as the difference of longitude between the camp and Fort Yukon. Taking the mean of the stationary rates ‡ of his six chronometers, viz, from 9 days at the camp and 3 days at the Old Rampart house, the difference of longitude is found as follows:

		m.	s.	
From M. T. chronometer	1713	2	42·0	mean 2m 41s·4
" " "	1911		42·2	
" " "	301		42·2	
" Sid. "	215		39·5	
" " "	1739		40·1	
" " "	223		42·6	

and the longitude of the Old Rampart house becomes $9^h\ 23^m\ 56^s\!\cdot9+2^m\ 41^s\!\cdot4=9^h\ 26^m\ 38^s\!\cdot3$, or $141^\circ\ 39'\ 34''\!\cdot5$. Its latitude is $67^\circ\ 09'\ 42''\ \pm9''$.

Similarly taking the mean stationary rates ‡ as determined at the Old Rampart house (3 days) and at Fort Yukon (3 days), but rejecting the results by two chronometers as running wild, we have for the difference of longitude of these two places:

		m.	s.	
From M. T. chronometer	1713	14	31·1	mean 14m 36s·8
" " "	1911		34·7	
" " "	301		39·2	
" Sid. "	223		42·0	

and the longitude of Fort Yukon becomes

$9^h\ 26^m\ 38^s\!\cdot3+14^m\ 36^s\!\cdot8=9^h\ 41^m\ 15^s\!\cdot1$ or $145^\circ\ 18'\ 46''\!\cdot5$

Longitude of Fort Yukon according to Capt. C. W. Raymond, U. S. A., in 1869	$9^h\ 41^m\ 11^s\!\cdot1$ or $145^\circ\ 17'\ 47''$
and longitude of same according to Assistant J. E. McGrath, June, 1891	$9^h\ 41^m\ 08^s\!\cdot1$ or $145^\circ\ 17'\ 01''\!\cdot5$
Mean position adopted	$9^h\ 41^m\ 11^s\!\cdot4$ or $145^\circ\ 17'\ 51''$

which value should now be used on the charts of the Yukon in preference to the older determination.

* Measures were made on June 1, 1890, at midnight, with the sun about two diameters above the horizon.

† Report of a reconnoissance of the Yukon River, Alaska, July to September, 1869, by Capt. C. W. Raymond U. S. E., Washington, D. C., 1871.

‡ Rates worked out by Mr. Flynn.

3. ST. MICHAEL.

(J. H. Turner, observer. October, 1890, to March, 1891.)

[For description of station and instrument see report on the latitude observations.]

At this station, between October, 1890, and March, 1891, there were observed 26 moon culminations, including ☾I and ☾II, and 5 occultations, *all* immersions. They were computed by Mr. D. L. Hazard* and the computation of the culminations was checked by Mr. H. F. Flynn. The observations of the occultations were independently computed by Mr. Flynn; this was necessary as no computation by Mr. Turner could be found. The individual results are given in the following table, the treatment being the same as in the case of the longitude of Camp Colonna.

Observations marked † depend on Greenwich ephemeris corrected; * rejected as outside the limit of tolerance. Seconds without mark in columns Greenwich and San Francisco depend on corresponding observations at these places. The column headed "Resulting values" contains the results reduced to ½ (☾I & ☾II). Respecting weights the following plan was adopted:

$p = 1$ to result from 1 limb observed at St. Michael combined with corrected lunar ephemeris; $p = 1{\cdot}4$ same with corresponding observation at Greenwich; $p = 1{\cdot}8$ same with corresponding observation at San Francisco; $p = 2$ same when observed at all stations; $p = 3$ when both limbs were observed at St. Michael together with corresponding observations at the other two stations.

Recapitulation of results for longitude at St. Michael, Alaska.

$10^h\ 46^m$ + tabular quantities.

Date	Greenwich ☾I.	Greenwich ☾II.	San Francisco ☾I.	San Francisco ☾II.	Means ☾I.	Means ☾II.	Resulting values.	Weights p
1890.	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	
Oct. 24.	64·6†				64·6		67·6	1·0
" 25.	64·7	75·7	58·4	69·4	61·6	72.6	67·1	3·0
Nov. 23.	61·4†		60·9		61·1		64·1	1·8
" 24.	62·7				62·7		65·7	1·4
" 25.	66·7	68·2	65·4	66·9	66·0	67·6	66·8	3·0
" 26.	[77·3]*	75·0	[76·9]*	74·6		74·8	71·8	2·0
Dec. 17.	[74·8]*							
" 19.	67·7†		57·3		61·6		64·6	1·8
" 21.	64·1		59·7		61·9		64·9	2·0
" 22.	59·0†		55·1		56·7		59·7	1·8
" 23.	61·8†		58·9		60·1		63·1	1·8
" 29.		61·1†				61·1	58·1	1·0
" 31.		62·7†	.			62·7	59·7	1·0
1891.								
Jan. 2.		60·0†				60·0	57·0	1·0
" 4.		61·2		63·4		62·3	59·3	1·4
" 14.	58·2				58·2		61·2	1·4
" 16.	61·1				61·1		64·1	1·4
" 17.	58·9		58·2		58·6		61·6	2·0
" 18.	56·3		50·0		53·2		56·2	2·0
" 19.	63·1†		58·6		60·5		63·5	1·8
" 24.	62·6	65·1	63·6	66·1	63·1	65·6	64·4	3·0
" 25.		64·8		67·3		66·0	63·0	2·0
Feb. 17.	60·8				60·8		63·8	1·4
" 20.	63·8†		64·1		64·0		67·0	1·8
Mar. 18.	61·0		63·8		62·4		65·4	2·0
" 19.	61·3				61·3		64·3	1·4
			Weighted means		61·0	67·0	63·8	
			Difference		6ˢ·0			

The weighted mean $\lambda = 10^h\ 48^m\ 03^s{\cdot}8 \pm 0{\cdot}675 \sqrt{\frac{[pvv]}{[p](n-1)}}$ or $\pm 0^s{\cdot}5$

* Some of the transit reductions are due to Assistant Mosman.

The results from the occultations are as follows:

Date.	Star.	Longitude.
		s.
1890, Oct. 24.	33 Piscium.	10h 48m 07·3
1891, Jan. 14.	30 "	05·0
" " 14.	33 "	05·5
" " 14.	17 B. A. C.	09·8
" " 17.	38 Arietis.	07·9
	Mean	10h 48m 07s·1 ± 0s·6?

These values depend on corrected lunar ephemeris, and in connection with the results from the culminations each has the relative weight 2 assigned to it.

Combined with preceding result the final longitude of St. Michael becomes

$10^h\ 48^m\ 04^s{\cdot}4 \pm 0^s{\cdot}4$ or $162^\circ\ 01'\ 06'' \pm 6''$

4. ANCHORAGE POINT, CHILKAT INLET.

(May to August, 1894.)

[For description of station and instrument see report on the latitude observations.]

The longitude of this station was determined in 1894 by a series of chronometer transportations between it and Sitka. The office computation was made by Mr. D. L. Hazard.* The transit observations at Sitka (station of 1892) were made by Assistant F. Morse between May 12 and August 18, 1894. From May 12 to 20, meridian telescope No. 7 was used, and for the rest of the observations meridian telescope No. 16 (focal length 78 cm., aperture 6·6 cm., magnifying power ? 1 div. of striding level $2''{\cdot}109$, pivot inequality $p=+0^s{\cdot}030$ for illumination W.). Observing chronometer Hutton No. 194 (sid.). Auxiliary chronometers Negus No. 1589 (sid.) and Fletcher No. 1713 (M. T.) were kept rated by daily comparisons with No. 194. Accurate local time for any date was thus secured.

At Anchorage Point the observations for time were made by J. F. Hayford (J. F. Pratt, chief of party) between May 15 and August 12, 1894. Meridian telescope No. 9 was used. Focal length 64 cm., aperture 5 cm., magnifying power 43; one division of striding level $1''{\cdot}92$. Observing chronometer Bond No. 380 (sid.). Auxiliary chronometers Frodsham No. 4969 (M. T.), Frodsham No. 2490 (M. T.), Hutton No. 207 (sid.), and Frodsham No. 2637 (sid.) were kept rated by means of daily comparisons.

The comparison of the local times at the two stations was effected by the transportation of 9 chronometers on board the C. & G. S. steamer *Hassler*, Lieut. G. B. Harber, U. S. N., in command, making 7½ round trips between these places. Daily comparisons of the chronometers were made by J. Page (under the direction of Assistant Morse). On arrival and departure of the steamer at each place the observing chronometer was brought on board and compared with the traveling chronometers.

Two results were obtained, the first depending on the traveling rates from the round trips starting from Chilkat, the second depending on the traveling rates from the round trips starting from Sitka. As there were 7½ round trips the last half trip was omitted in obtaining the first result and the first half trip in the second case. Weights to the results depend on the variations in the rates of the chronometers, on the duration of the trip, the interval between the comparisons of the observing and traveling chronometers and the time elapsed since the last time determination being included in the actual traveling time. There are no observations for difference of personal, equation of the two observers.

* The field computation is by Assistant F. Morse.

The results by the individual chronometers and trips are as follows:

1894. ***Difference of longitude between Sitka and Anchorage Point, Chilkat Inlet, Alaska.***

SUMMARY OF RESULTS FROM SEVEN ROUND TRIPS, STARTING FROM ANCHORAGE POINT, CHILKAT INLET.

Chronometers, M. T. or Sid.		1st	2d	3d	4th	5th	6th	7th	Means. $\Delta\lambda$	Weights.
		m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	
M. T.	231	0 28·03	0 26·36	0 28·36	0 28·19	0 28·45	0 28·19	0 28·18	0 27·97	3
	1507	28·44	29·06	29·18	28·26	28·27	28·20	28·54	28·56	4
	1510	28·57	29·25	29·00	28·52	28·63	28·06	28·58	28·66	7
	196	28·59	29·09	29·54	28·59	28·43	28·51	28·92	28·81	3
	1542	28·11	28·11	28·66	28·23	28·47	28·38	28·37	28·33	22
	1728	28·66	28·94	29·16	28·63	28·58	28·43	28·59	28·71	6
	208	27·95	27·40	28·21	28·19	28·42	28·42	28·09	28·10	6
	2167	28·21	28·56	28·90	28·55	28·68	28·27	28·64	28·54	17
Sid.	387	28·20	28·44	28·91	27·93	28·41	27·93	28·59	28·34	6
Mean		0 28·31	0 28·36	0 28·88	0 28·34	0 28·48	0 28·27	0 28·50	0 28·45	
Weighted mean		28·25	28·38	28·82	28·35	28·52	28·28	28·49	28·44	
Weight p		3	1	2	2	2	1	2		

Weighted mean $0^h\ 0^m\ 28^s{\cdot}44 \pm 0^s{\cdot}05$

SUMMARY OF RESULTS FROM SEVEN ROUND TRIPS, STARTING FROM SITKA.

Chronometers, M. T. or Sid.		1st	2d	3d	4th	5th	6th	7th	Means, $\Delta\lambda$	Weights.
		m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	*m. s.*	
M. T.	231	0 28·87	0 28·78	0 28·74	0 28·39	0 28·37	0 28·71	0 28·11	0 28·57	3
	1507	27·69	29·08	29·11	27·76	28·78	27·93	28·64	28·43	4
	1510	28·37	28·88	28·82	27·91	28·83	28·10	28·58	28·50	7
	196	28·59	29·07	28·95	27·66	28·03	29·56	29·20	28·72	3
	1542	28·93	28·57	28·59	28·22	28·50	28·50	28·32	28·52	22
	1728	27·59	28·90	28·75	27·99	29·01	28·09	28·75	28·44	6
	208	27·71	28·03	28·52	28·58	27·88	28·76	27·65	28·16	6
	2167	28·24	28·71	28·80	28·27	28·77	28·31	28·49	28·51	17
Sid.	387	28·68	28·80	28·43	27·69	28·97	27·98	28·73	28·47	6
Mean		0 28·30	0 28·76	0 28·75	0 28·05	0 28·57	0 28·44	0 28·50	0 28·48	
Weighted mean		28·41	28·69	28·70	28·13	28·61	28·38	28·44	28·48	
Weight p		1	2	2	2	2	2	2		

Weighted mean $0^h\ 0^m\ 28^s{\cdot}48 \pm 0^s{\cdot}05$

	h. m. s. s.
Final mean $\Delta\lambda$	$= +0\ \ 00\ \ 28{\cdot}46 \pm 0{\cdot}05$
Longitude of Sitka, transit of 1892–93	$9\ \ 01\ \ 21{\cdot}48 \pm 0{\cdot}13$ ‡
Longitude of Anchorage Point *	$9\ \ 01\ \ 49{\cdot}94 \pm 0{\cdot}14$
or	$135°\ 27'\ 29''{\cdot}10 \pm 2''{\cdot}10$

This result will be used for the triangulation of the Chilkat Inlet and adjacent region.

In connection with the transit observations at Anchorage Point the meridian mark was made use of to provide the triangulation with a good azimuth.

5. PORT SIMPSON, B. C., AND LION POINT, PORTLAND CANAL, B. C.

[For description of stations and instruments see report on the latitude observations.]

The longitudes of Port Simpson and Lion Point were determined in 1895 by a series of chronometer transportations, the first-named place being made to depend on the telegraphic longitude of Seattle, Wash., viz: $8^h\ 09^m\ 20^s{\cdot}32 \pm 0^s{\cdot}08$.

At Seattle the station is in the grounds of the State University. The time observations were

*** In 1867 and 1869 Assistant Davidson visited this place and his longitude of Pyramid Island (center of inlet) is given in Dall and Baker's Pacific Coast Pilot, Coast and Geodetic Survey, Washington, D. C., 1883 as $9^h\ 01^m\ 48^s{\cdot}3$ W.**

‡ C. & G. S. Report for 1894, pt. 2, p. 83.

made by Assistant F. Morse with meridian telescope No. 16, between April 23 and July 7, 1895. Observing chronometer Hutton No. 194 (sidereal) was used also as a "hack" for comparison with chronometers transported on board the *City of Topeka*. Mean time chronometer Fletcher No. 1713 and sidereal chronometer Negus No. 1825 were kept rated by means of comparisons with the observing chronometer. The field reduction is by the observer, the office reduction by Mr. D. L. Hazard; only those sets of transits were computed which immediately precede or follow a comparison with the *City of Topeka* chronometers.

At Port Simpson the observations for time were made by Mr. O. B. French with meridian telescope No. 2. Sidereal chronometer Frodsham No. 3462 was used in observing transits, also as a "hack." Sidereal chronometer No. 3477 and mean time chronometer No. 2171 were kept rated by means of comparisons.

The observations comprise the period May 6 to July 9, 1895. The field computation was made by the observer, aided by C. C. Yates, the office computation by D. L. Hazard.

At Lion Point the transit observations were made by Assistant P. A. Welker with meridian telescope No. 13, between May 14 and July 27, 1895. Sidereal chronometer Negus No. 1823 was used as observing chronometer as well as "hack." Sidereal chronometer No. 3479 and mean time chronometer No. 1718 were kept rated.

For the determination of the longitude of Port Simpson 9 chronometers were transported on the steamer *City of Topeka* for 4 round trips, and for the determination of the longitude of Lion Point 5 chronometers were transported on the C. & G. S. steamer *Fuca* for 6½ round trips. Assistant F. A. Young accompanied the chronometers to and from Port Simpson and made daily comparisons on board the *Topeka*. The average duration of a trip between Seattle and Port Simpson was about three days, and between Port Simpson and Lion Point about three-fourths of a day.

In computing at the office the differences of longitude the plan adopted for previous chronometric differences of longitude in Alaska was followed. (See report on the longitude of Anchorage Point, 1894.)

There were no observations for personal equation. In the case of the determination of Lion Point, the work begins there and the results are combined as before, except that when Port Simpson is taken as a starting point the first (half) trip is neglected and when Lion Point is taken as the starting point the last (half) trip is not used.

Difference of longitude of Seattle and Port Simpson.

SUMMARY OF RESULTS OF FOUR ROUND TRIPS STARTING FROM SEATTLE.

Chronometers.		1st		2d		3d		4th		Means, Δ λ		Weights.
		m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	
M. T.	1707	32	23·63	32	22·69	32	22·75	32	22·29	32	22·84	20
"	229		25·76		23·42		22·56		23·33		23·77	1
"	2535		22·59		22·78		23.04		22·76		22·79	25
"	1542		22·90		22·42		21 75		22·29		22·34	26
"	231		23·16		23·02		21·71		21·97		22·46	10
Sid.	220		22·22		22·60		21·96		22·49		22·32	87
"	1840		21·85		22·81		23·22		23·14		22·76	5
"	1589		22·99		22·44		21·41		22·26		22·28	11
"	1838		22·81		22·74		21·84		22·51		22·47	22
Mean		32	23·10	32	22·77	32	22·25	32	22·56	32	22·67	207
Weighted mean			22·64		22·64		22·12		22·46		22·47	
p			4		4		2		4			

Weighted mean $32^m\ 22^s{\cdot}51 \pm 0^s{\cdot}07$

Differences of longitude of Seattle and Port Simpson—Continued.

SUMMARY OF RESULTS OF FOUR ROUND TRIPS STARTING FROM PORT SIMPSON.

Chronometers.		1st	2d	3d	4th	Means, Δ λ	Weights.
		m. *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	
M. T.	1707	32 22·73	32 22·38	32 22·82	32 23·52	32 22·86	20
"	229	23·07	22·02	21·80	28·58	23·87	1
"	2535	22·31	22·39	22·75	23·70	22·79	25
"	1542	22·55	21·97	22·03	22·92	22·37	26
"	231	22·78	22·06	21·80	23·40	22·51	10
Sid.	220	22·57	22·25	22·39	22·07	22·32	87
"	1840	23·08	23·21	23·91	20·66	22·72	5
"	1589	22·57	21·84	21·61	23·24	22·32	11
"	1838	22·49	22·22	22·01	23·30	22·50	22
Mean		32 22·68	32 22·26	32 22·35	32 23·49	32 22·70	207
Weighted mean		22·57	22·24	22·36	22·77	22·48	
p		4	3	3	4		

Weighted mean $32^m\ 22^s.51 \pm 0^s.08$

Hence Port Simpson west of Seattle $0^h\ 32^m\ 22^s.51 \pm 0^s.08$

Difference of longitude of Port Simpson and Lion Point.

SUMMARY OF RESULTS FROM SIX ROUND TRIPS STARTING FROM PORT SIMPSON.

Chronometers.		1st	2d	3d	4th	5th	6th	Mean, Δ λ	Weight.
		m. *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	
M. T.	1507	1 37·75	1 37·69	1 38·13	1 38·22	1 38·20	1 38·64	1 38·10	8
"	1510	37·90	37·82	38·14	38·34	38·24	38·60	38·17	10
"	297	38·10	38·36	37·89	37·89	39·04	38·28	38·26	3
"	557	38·13	37·93	37·62	38·08	38·17	38·40	38·06	10
Sid.	387	37·57	37·35	38·04	38·24	38·08	38·69	38·00	5
Means		1 37·89	1 37·83	1 37·96	1 38·15	1 38·35	1 38·52	1 38·12	36
Weighted means		37·90	37·82	37·96	38·19	38·26	38·54	38·11	
p		21	16	20	23	12	8		

Weighted mean $1^m\ 38^s.06 \pm 0^s.06$.

SUMMARY OF RESULTS FROM SIX ROUND TRIPS SARTING FROM LION POINT.

Chronometers.		1st	2d	3d	4th	5th	6th	Mean, Δ λ	Weight.
		m. *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	*m.* *s.*	
M. T.	1507	1 37·57	1 37·73	1 38·01	1 38·11	1 38·26	1 38·44	1 38·02	8
"	1510	37·59	37·83	38·13	38·14	38·35	38·48	38·09	10
"	297	38·94	37·79	38·27	37·18	38·60	37·80	38·10	3
"	557	38·04	37·86	38·17	37·50	38·51	38·18	38·04	10
Sid.	387	37·62	37·53	37·85	38·06	38·24	38·38	37·95	5
Means		1 37·95	1 37·75	1 38·09	1 37·80	1 38·39	1 38·26	1 38·04	36
Weighted means		37·83	37·77	38·09	37·86	38·38	38·32	38·04	
p		21	15	26	19	11	8		

Weighted mean $1^m\ 37^s.99 \pm 0^s.06$.

Hence Lion Point east of Port Simpson $1^m\ 38^s.03 \pm 0^s.06$

RESULTING LONGITUDE OF PORT SIMPSON (1895) AND OF LION POINT.

Allowing $\pm 0^s \cdot 10$ for personal equation we get the final longitudes as follows:

$$\text{Port Simpson } \lambda = \underset{\pm \cdot 08}{8^h\ 09^m\ 20^s \cdot 32} + \underset{\pm \cdot 13}{0^h\ 32^m\ 22^s \cdot 51} = \underset{\pm \cdot 15}{8^h\ 41^m\ 42^s \cdot 83} \text{ W. of G.}$$

In my report of December 27, 1893, I gave the longitude of the 1892 station at Port Simpson resulting from a single trip (time determinations by Lieutenant Poundstone, U. S. N.) as $8^h\ 41^m\ 44^s \cdot 19 \pm 0^s \cdot 40$; referred to the 1895 station this becomes $8^h\ 41^m\ 43^s \cdot 38 \pm 0^s \cdot 40$, hence by combination with regard to probable errors, we have finally

$$\lambda \text{ Port Simpson (1895 station on hill) } \underset{\pm\ 0 \cdot 15}{8^h\ 41^m\ 42^s \cdot 90} = \underset{\pm\ 2.25}{130^\circ\ 25'\ 43'' \cdot 50} \text{ W. of G.}$$

Subtracting $\Delta \lambda = 1^m\ 38^s \cdot 03 \pm 0^s \cdot 06$ we get

$$\lambda \text{ Lion Point } \quad \underset{\pm\ 0 \cdot 16}{8^h\ 40^m\ 04^s \cdot 87} = \underset{\pm\ 2 \cdot 40}{130^\circ\ 01'\ 13'' \cdot 05}$$

6. PORT SIMPSON, B. C., AND MARY ISLAND, REVILLAGIGEDO CHANNEL, ALASKA.

[For description of station Port Simpson and of instruments see report on the latitude observations.]

The longitude of Mary Island depends on chronometer transportations between Port Simpson and Mary Island, and the same chronometers and methods of observing and computing were employed as in the case of the Port Simpson longitude.

Time observations at Mary Island.—The astronomic station occupied in 1895, May to July, was 69·2 feet from the southwest corner of the custom-house and bearing S. 40° W. from it, and is marked by a brick pier upon which meridian telescope No. 1 was mounted for time observations. The transits were observed by E. F. Dickins, assistant, and noted by sidereal chronometer Hutton No. 207, which was compared with mean time chronometer Frodsham No. 4969 and sidereal chronometer Bond No. 380. The field reduction is by the observer and C. C. Yates and the office reduction and computation for difference of longitude is by D. L. Hazard.

Chronometer transportations.—Nine chronometers were carried on board the steamer *City of Topeka* and four round trips were made between Port Simpson and Mary Island. The passage from one to the other place consumed about a quarter of a day. The method of reduction being that previously explained, we have the following table of results:

Difference of longitude of Port Simpson and Mary Island.

SUMMARY OF RESULTS OF FOUR ROUND TRIPS, STARTING FROM PORT SIMPSON.

Chronometers.		1st trip.	2d trip.	3d trip.	4th trip.	Mean, Δλ	Weights.
		m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	
M. T.	1707	3 10·48	3 10·92	3 10·85	3 10·57	3 10·70	20
"	229	10·98	11·07	11·00	10·58	·91	1
"	2535	10·55	10·99	10·94	10·72	·80	25
"	1542	10·65	10·97	10·85	10·58	·76	26
"	231	10·66	11·01	10·80	10·58	·76	10
Sid.	220	10·51	10·95	10·93	10·52	·73	87
"	1840	10·31	10·87	10·87	10·44	·62	5
"	1589	10·62	10·92	10·91	10·55	·75	11
"	1838	10·65	10·90	10 88	10·52	·74	22
Mean		3 10·60	3 10·96	3 10·89	3 10·56	3 10·75	207
Weighted mean		10·55	10·95	10·90	10·56	10·74	
p		1	6	1·5	6		

Weighted mean $3^m\ 10^s \cdot 76 \pm 0^s \cdot 07$

Difference of longitude of Port Simpson and Mary Island—**Continued.**

SUMMARY OF RESULTS OF FOUR ROUND TRIPS, STARTING FROM MARY ISLAND.

Chronometers.		1st trip.	2d trip.	3d trip.	4th trip.	Mean, Δ λ	Weights.
		m. s.	*m. s.*	*m. s.*	*m. s.*	*m. s.*	
M. T.	1707	3 10·72	3 10·85	3 10·72	3 10·50	3 10·70	20
"	229	10·93	11·02	10·55	10·95	·86	1
"	2535	10·74	10·97	10·72	10·81	·81	25
"	1542	10·75	10·97	10·63	10·57	·73	26
"	231	10·72	10·99	10·60	10·67	·74	10
Sid.	220	10·72	11·01	10·68	10·32	·68	87
"	1840	10·70	10·88	10·73	09·99	·58	5
"	1589	10·72	10·98	10·63	10·51	·71	11
"	1838	10·70	10·96	10·63	10·49	·70	22
Mean		3 10·74	3 10·96	3 10·65	3 10·53	3 10·72	207
Weighted mean		10·72	10·97	10·67	10·47	10·71	
p		6	2	3	1		

Weighted mean $3^m\ 10^s.73 \pm 0^s.05$

Hence Mary Island west of Port Simpson	$3^m\ 10^s.74 \pm 0^s.06$
Longitude of Port Simpson (transit of 1895)	$8^h\ 41^m\ 42^s.90 \pm 0^s.15$
Longitude of Mary Island, W. of G.	$8^h\ 44^m\ 53^s.64 \pm 0^s.16$
or	$131^\circ\ 13'\ 24''.60 \pm 2''.40$

APPENDIX No. 4—1895.

OBSERVATIONS OF THE TRANSIT OF MERCURY ON NOVEMBER 10, 1894, MADE AT THE COAST AND GEODETIC SURVEY OFFICE, WASHINGTON, D. C.

Report by CHAS. A. SCHOTT.
O. H. TITTMANN.
E. D. PRESTON.
EDWIN SMITH.
G. R. PUTNAM.
E. G. FISCHER.

STATION.

In lot adjacent to and south of the United States Coast and Geodetic Survey Office on Capitol Hill, Washington, D. C. Position by triangulation, latitude 38° 53′ 12″ north, longitude 77° 00′ 24″ or 5^h 08^m $01^s.6$ west of Greenwich.

INSTRUMENTS.

The following table gives a description of the instrument used by each observer:

Observer.	Instrument.	Aperture.	Focal length.	Magnifying power.
		cm.	*cm.*	
C. A. Schott.	Equatorial by Dolland.	10·2	183	40
O. H. Tittmann.	Zenith telescope No. 5.	9·0	124	90
E. D. Preston.	Reconnoitering telescope No. 30.	9·0	98	90
Edwin Smith.	Zenith telescope No. 4.	7·9	118	99
G. R. Putnam.	Reconnoitering telescope No. 4.	5·7	94	40
E. G. Fischer.	Reconnoitering telescope No. 59.	6·2	75	38

TIMEPIECE AND CORRECTIONS.

Mean time chronometer Molyneux No. 1718 was used by all the observers, the seconds being counted aloud by persons not observing. The corrections to this chronometer on seventy-fifth meridian time were as follows:

Nov. 10 —10^h 31^m (75th mer. time) fast 0^h 00^m $00^s.32$ (before 1st contact).
Nov. 10 —11 07 (" " ") " 0 00 00 ·28 (after 2d contact).

These corrections are derived from comparisons with sidereal chronometers Negus 1823 and Negus 1824, the corrections to which were determined by star transit observations, in the small

observatory near the office, by G. R. Putnam. Molyneux No. 1718 was also compared with the noon signals from the Naval Observatory, received, telegraphically, as follows:

Nov. 8, 1894—	No. 1718 is fast $0^h\ 00^m$	$00^s.2$
Nov. 9, 1894—	" " " "	00.3
Nov 10, 1894—	" " " "	00.6

which agrees well with the above. The error being so small no correction is applied to the transit of Mercury observations.

Observed time of contacts (chronometer time).

Observer.	1st contact.	2d contact.	3d contact.	4th contact.
	h. m. s.	h. m. s.		
C. A. Schott.	10 57 09	10 58 25	Lost by clouds.	Lost by clouds.
O. H. Tittmann.	10 57 00	10 58 26		
E. D. Preston.	Not obs'd.	10 58 18		
Edwin Smith.	10 57 00	10 58 23		
G. R. Putnam.	10 57 00	10 58 25		
E. G. Fischer.	10 56 43	10 58 18		

REMARKS BY OBSERVERS.

C. A. Schott.—Instrument by Dolland, London, mounted equatorially, but very unsteady. Little value is attached to observation of the external contact, supposed to be about 15^s too late, sun's limb very unsteady, and wind shaking telescope. The time of the interior contact is that of the first streak of light flashing around the eastern limb of the planet; it closed up again and reopened, perhaps in half a second. Third and fourth contact lost by a cloud; two and a half minutes before third contact a heavy cloud rolled up before the sun, hiding it for about 6 minutes.

O. H. Tittmann.—First contact, the planet was quite perceptibly on the sun's limb. Second contact, time of rupture of black drop.

E. D. Preston.—Second contact, last dark band $10^h\ 58^m\ 11^s$, first light $10^h\ 58^m\ 26^s$, mean $10^h\ 58^m\ 18^s$.

Edwin Smith.—Edge of sun, fair. First contact late, planet well on. Second contact uncertain; it may be anywhere between 10^s and 35^s.

APPENDIX No. 5—1893.

REPORT ON THE CHANGES IN THE DEPTHS ON THE BAR AT THE ENTRANCE TO NANTUCKET INNER HARBOR, MASSACHUSETTS, BETWEEN THE YEARS 1888 AND 1893.

By H. L. MARINDIN, Assistant.

The harbor of Nantucket is to be classed among the harbors of refuge, and it is only as such that the General Government can entertain the project of any improvement for obtaining deeper water over the bar.

The following statistics, kindly furnished by the collector of the port, Mr. Joseph W. Clapp, exhibit the value of the imports and exports for the year 1893:

Port of Nantucket—Table of statistics for 1893.

Name of article.	Value of—		Total.	Tonnage.
	Exports.	Imports.		
Tobacco		$39 500		
Rice		960		
Grain and forage		28 000		900
Vegetables	$1 000	10 000	$11 000	
Live stock and produce		9 000		
Lumber		15 300		
Coal and minerals		42 500		7 000
Fresh fish and shellfish	12 500	3 000	15 500	
Fertilizers		20 000		
Machinery		20 000		
General merchandise	500	120 000	120 500	
Gain in navigation during year:				
1 sailing packet				16
1 new catboat				7
Means of transportation:				
1 steamer running as mail packet				460
Number of passengers carried (estimated) ... 12 000				
Number of excursionists ... 4 000				
Number of licensed vessels (5 tons and upward) ... 19				
Average draft of vessels ... feet .. 5 to 8				
Number of unlicensed vessels ... 40				
Number of enrolled vessels (250 tons each) .. 3				
Number of fishing vessels ... 1				

It will be seen from the foregoing statistics that this alone would not warrant the expenditure of any large sum of money by the General Government in the improvement of harbor and bar, but, as this harbor is the only available refuge between Vineyard Haven on the west and Provincetown Harbor on the east, where a vessel in distress could find shelter during a northerly gale, which is the prevailing direction from which come the great winter storms, and lying as it does in the midst of dangerous shoals, it would seem that the Government is justified in pushing works of improvement at this port.

Roughly speaking, about 30 000 vessels pass through Nantucket Sound yearly, the majority of which draw less than 15 feet of water. The greater number of vessels wrecked on the island are wrecked on the north side where this harbor would be accessible to those in distress, provided the depth of water over the bar were sufficient; therefore, the project of improvement by jetties contemplated the creation of a channel with 12 to 14 feet depth at mean low water, which would thus accommodate the greater number of vessels passing through the sound. It was with this end in view that in 1880–1885 the plan of improvement by jetties was suggested and adopted by the United States Engineers.

At that date the bar was a formidable obstruction over 1 mile in width, with 6 feet of water at mean low tide. This depth had obtained for many years without material change, and it would seem to have been the measure of the scouring forces of the tide as it filled and drained the inner basin.

The plan adopted promised an increase of depth on the bar to 12 or 14 feet, but at the date of our recent survey this promise had not been fulfilled, doubtless because the jetties remain unfinished, and have deteriorated, as all such incomplete works do on the seaboard.

The west jetty, which was begun in 1881, was completed to its present length in 1884; up to that time, however, no effect, either favorable or unfavorable, could be traced to this work.

During the following year, in 1885, it was recommended that an eastern jetty be constructed. The work was pushed for a number of years, with some interruptions from lack of funds, and in 1889 the depth of water was found to have increased to 7½ feet on the shoalest part of the bar.

In order to form a more intelligent understanding of the results indicated in this report it seemed advisable to present as an introduction the foregoing retrospect in the history of the projected improvements of the bar and channels, obtained chiefly from the inspection of the numerous reports of the United States Engineers since 1880.

To fully discuss the physical hydrographic changes due to the action of the jetties, it is necessary to have in hand a series of observations of the currents on the bar and in the channels, both before the location of the jetties and since their construction; these are wanting, however, so we are compelled to limit our inquiry to the comparison of the depths and the shift of channels during that period.

The plane of reference for the soundings of 1888 could not be recovered, owing to the destruction of the part of the wharf on which the bench mark was established, but as this plane was obtained from observations of the tide during one lunar month, and that for the soundings of 1893–94 was based on observations for a somewhat longer period, it does not seem unreasonable to accept the two as sufficiently identical, especially as the mean range of the tide agreed remarkably well in both instances.

The plane of reference for this comparison is found to be 4.3 feet below the bench mark of 1854 on Commercial Wharf; this height is still 0.5 foot higher than that which the bench mark of 1854 gives as the mean low-water plane from the tidal observations made during that year. This difference can not as yet be explained by the sinking of the wharf on which the bench is established, because we find no change in the difference in height between the Commercial Wharf bench and the inland bench mark at "Palmers Rock," the height of which was obtained by a line of levels in 1854 and again by two lines of levels in 1894. The solution of the question might lie in a repetition of the tidal observations of 1854 under as nearly similar conditions as could be obtained, but the cost of making the observations precludes the employment of this mode of solution.

DISCUSSION OF THE ACCOMPANYING DIAGRAMS 1 TO 4 AND TABLES 1 TO 6.

The four accompanying diagrams and tables of cross sections fully illustrate the changes. The location of the cross sections was determined by finding full lines of soundings on the survey of 1888 coinciding with similar lines in location and direction on the survey of 1893, and in order to recover the position of these sections at any future time, we have given the geographical position of the origin and end of the section.

The location of the sections and their comparisons are shown in diagrams 1 and 2. In each case the mean depth and mean difference is noted. This mean difference, however, does not

indicate the important material change where a channel over a bar is concerned, which is the least depth of channel way, but it indicates the general change over the entire width, and should not be confounded with the other.

The cross section on AB, at the inner end of the bar, indicates a general shoaling, heavy on the flats at Coatue Point, and again heavy in the deep hole near the Brant Point shore.

The next cross section on AC shows the shoaling and deepening as nearly balanced, with a mean increase of depth of 0·1 foot. The next section on AD again indicates the same as the preceding.

The next section on EF, lying fairly within the action of the jetties, is more important as indicating any effect from them. The mean difference here shows an increase of depth of 0·9 foot.

Section on GH lies without the mouths of the jetties; the mean depth also indicates an improvement of 0·4 foot.

We now come to Table 6, which gives the comparison of depths along the channel lines for 1888 and 1893. These two lines are not identical in position, the one for 1888 lying west of the channel line for 1893, but their comparison is admissible, and shows an amelioration of 0·6 foot over the distance covered. Again, it must not be inferred that this increase measures the value of the improvement over the bar. Such is not the case, since the least depth on the bar is the criterion, but it shows, as stated before, the general tendency along the line under consideration. Thus we find that while the longitudinal section over the bar, from deep water inside to deep water outside, shows an increase of depth of 0·6 foot, yet the shoalest depth in channel has remained stationery at 7½ feet at mean low tide—the same as observed in 1888–89.

This shoalest depth is found in two places in the channel way over the bar, one directly east of the outer end of the west jetty, and the other on a line joining the outer ends of the east and west jetties, but somewhat nearer the east jetty.

As stated before, these two channel lines do not coincide, the one for 1888 being to the westward of that for 1893. This shift of position to the eastward (see Diagram No. 1) is also indicated by the retreat of the 6-foot contour to the eastward off the outer end of the west jetty, thus widening the channel for this depth (6 feet) from 1 050 feet in 1888 to 1 843 feet in 1893.

Diagram No. 3 exhibits the respective areas of shoaling and deepening and those where no change has appeared. Out of a total area of 594 acres covered by the diagram shoaling has occurred over 266 acres and deepening over 296 acres, while 32 acres show no change in depth. This at first does not appear very favorable, since the area shoaled is but little less than the area deepened; but it will be observed that the bulk of the shoaling has occurred in the dead angle formed by the west jetty and the Brant Point shore, and also extensively on the flats off Coatue Point and in the false channel, while the deepening has obtained in the vicinity of the channel, with the exception of the northern end of the channel, which shows a slight decrease in depth.

Upon examining closely Diagram No. 4 it will be noted that a number of shoal spots are found dotted over the bar. These spots are called "hogs' backs" by the local boatmen, and are found in close proximity to the channel, if not directly in it. They have 5 and 6 feet of water over them at mean low tide, while the surrounding depth is from 1 to 3 feet greater, and are covered with a rank growth of seaweed, which protects them effectually from erosion by the tidal currents. It is reasonable to infer that should these "hogs' backs" be once removed by the dredge their reappearance would be prevented by the tidal currents, thus ridding the navigation of the bar of one of its serious obstructions.

A recapitulation of the results determined by this comparison may be summed up in the following:

1. It is shown that the location and construction of the jetties, even to their incomplete stage, has had a favorable effect in increasing the navigable depth over the bar.

2. The shoalest depth on the bar now remains stationary at 7½ feet at mean low tide—the same as it was in 1888–89.

3. The action of the jetties is at present negative, i. e., they merely serve the purpose of maintaining the present depth.

4. The results, however, warrant the contention that the completion of the project of improvement recommended and adopted by the United States Engineers in 1885 would lead to beneficial results in further increasing the navigable depth over this bar.

NANTUCKET HARBOR BAR.

Table 1.—*Section AB—From Coatue Point to Brant Point.*

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
0	0·0	—0·4	....	0·4	Position of origin.
100	8·2	7·1	....	1·1	Lat. 41° 17′ 45″·54.
200	9·5	6·6	....	2·9	Long. 70° 05′ 10″·02.
300	9·5	5·6	....	3·9	
400	9·5	4·1	....	5·4	
500	9·5	2·2	....	7·3	
600	5·4	1·6	....	3·8	
700	2·5	2·4	....	0·1	
800	2·5	3·1	0·6	....	
900	1·5	2·6	1·1	....	
1 000	2·5	2·6	0·1	....	
1 100	2·5	2·4	....	0·1	
1 200	2·5	2·1	....	0·4	
1 300	4·2	1·6	....	3·6	
1 400	4·5	1·8	....	2·7	
1 500	4·5	1·6	....	2·9	
1 600	6·0	5·6	....	0·4	
1 700	9·2	7·2	....	2·0	
1 800	12·0	11·1	....	0·9	
1 900	15·0	13·1	....	1·9	
2 000	18·5	17·6	....	0·9	
2 100	20·7	27·6	6·9	....	
2 200	29·0	28·6	....	0·4	End of section.
2 300	22·6	19·4	....	3·2	Lat. 41° 17′ 25″·47.
2 400	14·6	5·6	....	9·0	Long. 70° 05′ 29″·61.
2 470	0·0	2·4	....	2·4	Shore line—1888.
2 500	....	0·0	....	....	" " 1893.
Means	9·0	7·3	....	1·7	

Table 2.—*Section AC—From Coatue Point to Brant Point.*

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
0	0·0	0·0	0·0	0·0	Position of origin.
100	8·0	5·6	....	2·4	Lat. 41° 17′ 45″·54.
200	8·5	7·6	....	0·9	Long. 70° 05′ 10″·02.
300	7·8	5·1	....	2·7	
400	7·5	6·6	....	0·9	
500	6·5	3·6	....	2·9	
600	3·5	2·9	....	0·6	
700	6·0	2·0	....	4·0	
800	3·5	3·1	....	0·4	
900	3·5	4·6	1·1	....	
1 000	2·5	5·6	3·1	....	
1 100	2·5	4·1	1·6	....	
1 200	2·5	2·6	0·1	....	
1 300	2·5	2·3	....	0·2	
1 400	3·5	2·1	....	1·4	
1 500	3·5	1·8	....	1·7	
1 600	4·0	3·6	....	0·4	
1 700	4·5	4·3	....	0·2	
1 800	2·5	5·6	3·1	....	
1 900	2·5	6·3	3·8	....	
2 000	1·5	7·6	6·1	....	
2 100	6·5	9·6	3·1	....	
2 200	10·5	11·6	1·1	....	
2 300	11·5	12·3	0·8	....	

NANTUCKET HARBOR BAR—Continued.

TABLE 2.—*Section AC—From Coatue Point to Brant Point*—Continued.

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet*	*Feet.*	*Feet.*	*Feet.*	
2 400	11·5	12·1	0·6	....	
2 500	12·0	11·8	....	0·2	
2 600	13·5	12·1	....	1·4	
2 700	13·5	11·9	....	1·6	
2 800	13·5	12·2	....	1·3	
2 900	13·2	12·9	....	0·3	
3 000	12·5	12·8	0·3	....	
3 100	12·0	12·3	0·3	....	
3 200	5·2	5·6	0·4	....	
3 300	3·7	3·6	....	0·1	
3 400	3·5	3·3	....	0·2	
3 500	3·2	1·3	....	1·9	End of section.
3 600	1·7	1·3	....	0·4	Lat. 41° 17′ 33″·87.
3 700	1·4	0·8	....	0·6	Long. 70° 05′ 59″.24.
3 782	1·3	0·0	....	1·3	Shore line in 1893.
3 800	1·2	—0·2	....	1·4	
3 810	1·0	—0·4	....	1·4	
3 900	0·0	....	....	....	Shore line in 1888.
Means	6·1	6·2	0·1	....	

TABLE 3.—*Section on AD—From Coatue Point to West Jetty.*

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
0	....	0·0	....	....	Shore line in 1893.
25	0·0	....	....	....	Shore line in 1888.
100	6·6	5·8	....	0·4	Position of origin.
200	9·0	9·0	0·0	0·0	Lat. 41° 17′ 45″·54.
300	9·5	8·6	....	0·9	Long. 70° 05′ 10″·02.
400	8·4	7·4	....	1·0	
500	8·0	6·6	....	1·4	
600	2·4	5·4	3·0	....	
700	5·2	5·6	0·4	....	
800	5·7	3·4	....	2·3	
900	4·3	4·9	0·6	....	
1 000	3·7	5·2	1·5	....	
1 100	3·0	5·6	2·6	....	
1 200	2·5	3·2	0·7	....	
1 300	1·5	2·6	1·1	....	
1 400	1·0	2·7	1·7	....	
1 500	4·4	2·8	....	1·6	
1 600	5·7	2·6	....	3·1	
1 700	5·7	2·8	....	2·9	
1 800	4·2	2·8	....	1·4	
1 900	3·7	2·8	....	0·9	
2 000	3·0	3·3	0·3	....	
2 100	6·0	4·7	....	1·3	
2 200	7·4	5·5	....	1·9	
2 300	5·8	7·4	1·6	....	
2 400	5·9	10·2	4·3	....	
2 500	8·0	11·6	3·6	....	
2 600	8·4	9·8	1·4	....	
2 700	6·8	8·6	1·8	....	
2 800	7·5	7·6	0·1	....	
2 900	7·7	7·6	....	0·1	
3 000	6·8	7·9	1·1	....	
3 100	6·5	7·6	1·1	....	

NANTUCKET HARBOR BAR—Continued.

TABLE 3.—*Section on AD—From Coatue Point to West Jetty*—Continued.

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
3 200	7·2	6·1	....	1·1	
3 300	7·7	6·0	....	1·7	
3 400	8·0	7·8	....	0·2	
3 500	8·7	8·1	....	0·6	
3 600	10·3	8·6	....	1·7	
3 700	11·6	7·6	....	4·0	
3 800	11·7	9·6	....	2·1	
3 900	11·0	10·6	....	0·4	
4 000	9·2	9·8	0·6	....	
4 100	9·7	11·3	1·6	....	
4 200	9·0	10·6	1·6	....	
4 300	7·2	10·2	3·0	....	
4 400	5·8	7·8	2·0	....	
4 500	6·0	6·6	0·6	....	
4 600	5·7	6·6	0·9	....	
4 700	5·7	6·2	0·5	....	
4 800	5·1	5·6	0·5	....	
4 900	5·5	5·6	0·1	....	
5 000	4·8	5·4	0·6	....	End of section.
5 100	3·1	3·6	0·5	....	Lat. 41° 17′ 45″·41.
5 200	1·0	1·6	0·6	....	Long. 70° 06′ 18″·92.
5 260	0·0	—0·4	....	0·4	At West Jetty.
Means	6·3	6·3	0·0	0·0	

TABLE 4.—*Section on EF—From Coatue Flats to West Jetty.*

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
0	4·2	4·3	0·1	....	Position of origin.
100	4·2	5·2	1·0	....	Lat. 41° 17′ 58″·97.
200	6·0	6·0	0·0	0·0	Long. 70° 05′ 39″·55.
300	6·2	7·0	0·8	....	
400	6·9	8·1	1·2	....	
500	7·2	8·4	1·2	....	
600	8·0	8·8	0·8	....	
700	7·2	8·7	1·5	....	
800	7·2	8·6	1·4	....	
900	7·2	8·4	1·2	....	
1 000	8·2	8·3	0·1	....	
1 100	9·2	9·0	....	0·2	
1 200	8·2	8·6	0·4	....	
1 300	7·8	8·0	0·2	....	
1 400	7·2	7·4	0·2	....	
1 500	6·2	6·8	0·6	....	
1 600	5·7	6·3	0·6	....	
1 700	6·0	5·6	....	0·4	
1 800	5·2	5·6	0·4	....	
1 900	5·2	6·1	0·9	....	
2 000	6·0	6·6	0·6	....	
2 100	6·2	6·9	0·7	....	
2 200	7·0	7·1	0·1	....	
2 300	6·0	6·1	0·1	....	
2 400	6·2	5·8	....	0·4	End of section.
2 500	6·2	7·3	1·1	....	Lat. 41° 17′ 59″·58.
2 600	6·2	8·1	1·9	....	Long. 70° 06′ 15″·05.
2 718	2·0	0·6	....	1·4	At West Jetty.
Means	6·5	7·4	0·9	....	

NANTUCKET HARBOR BAR—Continued.

TABLE 5.—*Section on GH—From Coatue Flats to end of West Jetty.*

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
0	7·0	5·1	....	1·9	Position of origin.
100	7·0	5·4	....	1·6	Lat. 41° 18′ 15″·62.
200	7·0	5·6	....	1·4	Long. 70° 05′ 36″·90.
300	7·0	5·9	....	1·1	
400	8·0	6·2	....	1·8	
500	8·0	6·6	....	1·4	
600	6·0	6·8	0·8	....	
700	6·0	7·0	1·0	....	
800	6·0	7·3	1·3	....	
900	6·0	7·8	1·8	....	
1 000	6·0	8·3	2·3	....	
1 100	5·5	8·8	3·3	....	
1 200	5·7	8·4	2·7	....	
1 300	6·0	7·9	1·9	....	
1 400	7·0	7·3	0·3	....	
1 500	7·5	7·8	0·3	....	
1 600	6·2	8·1	1·9	....	
1 700	6·2	8·6	2·4	....	
1 800	8·0	9·1	1·1	....	
1 900	8·0	8·8	0·8	....	
2 000	8·0	8·4	0·4	....	
2 100	8·5	7·3	....	1·2	End of section.
2 200	9·0	8·1	....	0·9	Lat. 41° 18′ 16″·34.
2 300	8·0	3·6	....	4·4	Long. 70° 06′ 10″·49.
2 360	0·0	—0·4	....	0·4	Outer end of West Jetty.
Means	7·0	7·4	0.4	....	

TABLE 6.—*Section on IK—Along channel lines from Harbor to Bell Buoy.*

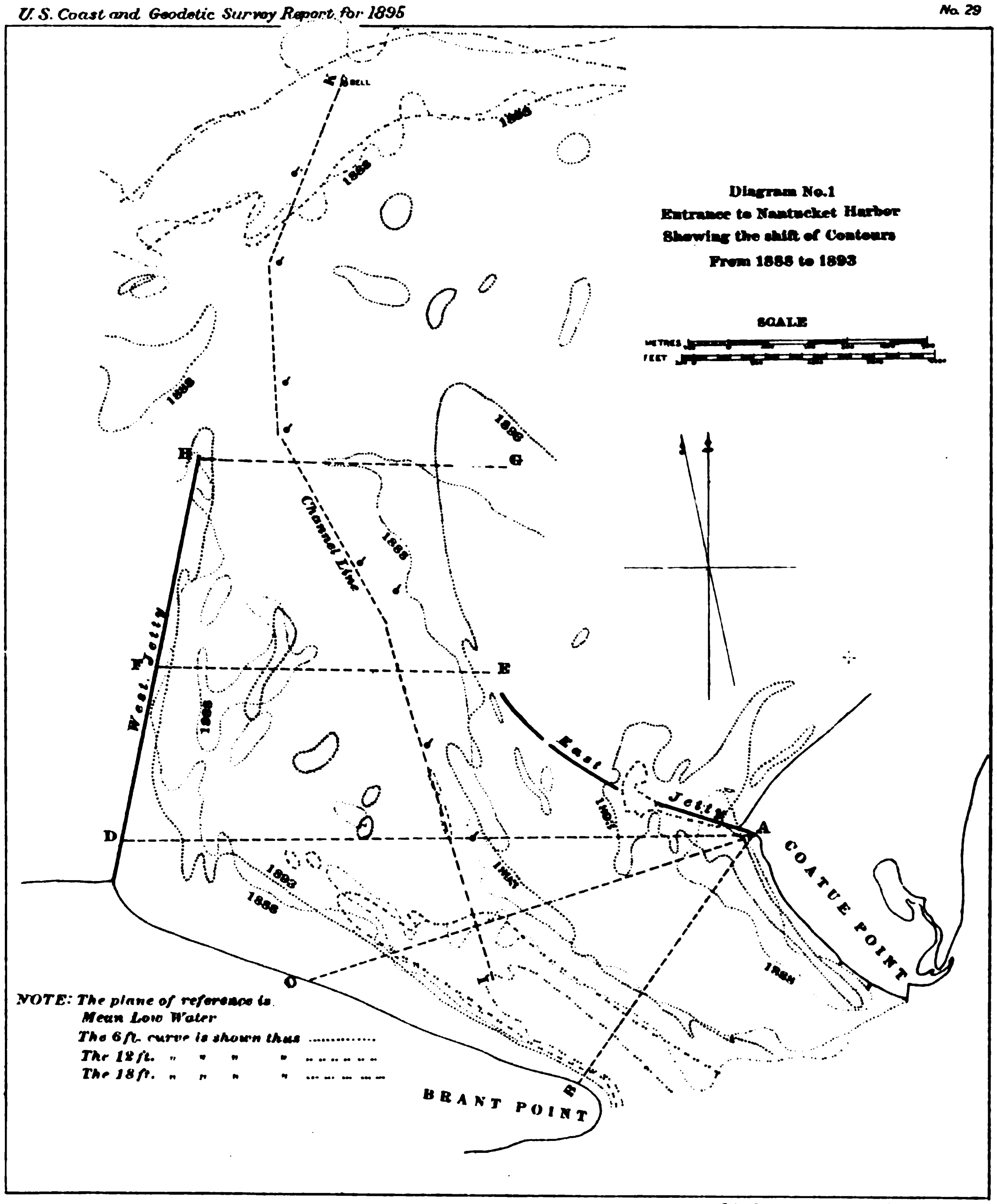
Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
0	18·0	17·6	....	0·4	Position of origin.
100	16·0	12·8	....	3·2	Lat. 41° 17′ 34″·45.
200	14·0	13·4	....	0·6	Long. 70° 05′ 38″.52.
300	13·6	13·0	....	0·6	
400	13·2	12·3	....	0·9	
500	11·0	11·6	0·6	....	
600	9·2	10·6	1·4	....	
700	9·5	10·2	0·7	....	
800	9·8	10·1	0·3	....	
900	9·8	10·2	0·4	....	
1 000	9·4	10·5	1·1	....	
1 100	9·0	10·8	1·8	....	
1 200	8·5	11·1	2·6	....	
1 300	8·0	11·7	3·7	....	
1 400	7·8	12·3	4·5	....	
1 500	7·5	11·6	4·1	....	
1 600	7·3	11·6	4·3	....	
1 700	7·0	11·1	4·1	....	
1 800	7·3	10·6	3·3	....	
1 900	7·5	10·8	3·3	....	
2 000	7·0	9·8	2·8	....	
2 100	7·4	10·6	3·2	....	
2 200	7·9	9·3	1·4	....	
2 300	8·3	9·6	1·3	....	
2 400	8·8	9·0	0·2	....	

NANTUCKET HARBOR BAR—Continued.

TABLE 6.—*Section on IK—Along channel lines from Harbor to Bell Buoy*—Continued.

Distance.	Depth at mean low water.		Differences.		Remarks.
	1888.	1893.	Deepened.	Shoaled.	
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
2 500	9·2	8·9	....	0·3	
2 600	9·0	8·8	....	0·2	
2 700	8·8	8·6	....	0·2	
2 800	8·5	8·1	....	0·4	
2 900	8·2	8·0	....	0·2	
3 000	7·8	7·8	0·0	0·0	
3 100	7·5	7·8	0·3		
3 200	7·7	7·7	0·0	0·0	
3 300	7·8	7·6	....	0·2	
3 400	8·0	7·7	....	0·3	
3 500	7·6	7·9	0·3	....	
3 600	7·2	8·1	0·9	....	
3 700	7·0	8·3	1·3	....	
3 800	7·0	8·6	1·6	....	
3 900	7·0	8·6	1·6	....	
4 000	7·3	8·6	1·3	....	
4 100	8·0	8·3	0·3	....	
4 200	7·8	8·1	0·3	....	
4 300	7·6	8·1	0·5	....	
4 400	7·6	8·1	0·5	....	
4 500	7·8	8·1	0·3	....	
4 600	7·9	8·1	0·2	....	
4 700	8·0	7·6	....	0·4	
4 800	8·0	7·7	....	0·3	
4 900	8·2	7·8	....	0·4	
5 000	8·4	8·8	0·4	....	
5 100	9·0	9·1	0·1	....	
5 200	7·8	8·6	0·8	....	
5 300	7·3	8·6	1·3	....	
5 400	7·8	8·1	0·3	....	
5 500	8·3	7·8	....	0·5	
5 600	8·5	8·6	0·1	....	
5 700	8·4	8·3	....	0·1	
5 800	8·3	8·1	....	0·2	
5 900	9·2	8·8	....	0·4	
6 000	10·0	9·3	....	0·7	
6 100	10·0	9·2	....	0·8	
6 200	10·8	9·1	....	1·7	
6 300	11·6	10·8	....	0·8	
6 400	12·2	11·1	....	1·1	
6 500	12·4	11·3	....	1·1	
6 600	12·7	12·3	....	0·4	
6 700	12·9	12·6	....	0·3	
6 800	13·1	12·1	....	1·0	
6 900	13·3	11·8	....	1·5	
7 000	13·5	13·6	0·1	....	
7 100	13·9	14·6	0·7	....	
7 200	14·3	15·8	1·5	....	
7 300	14·6	15·1	0·5	....	
7 400	15·0	15·1	0·1	....	End of section.
7 500	15·5	15·3	....	0·2	Lat. 41° 18′ 46″·52.
7 600	15·9	15·8	....	0·1	Long. 70° 05′ 54″·67.
7 700	13·3	16·1	2·8	....	At Bell Buoy. 1893.
Means	9·6	10·2	0·6	....	

Mean low-water plane of reference 4·3 feet below Mitchell's bench mark of 1854 on Commercial Wharf, Nantucket.



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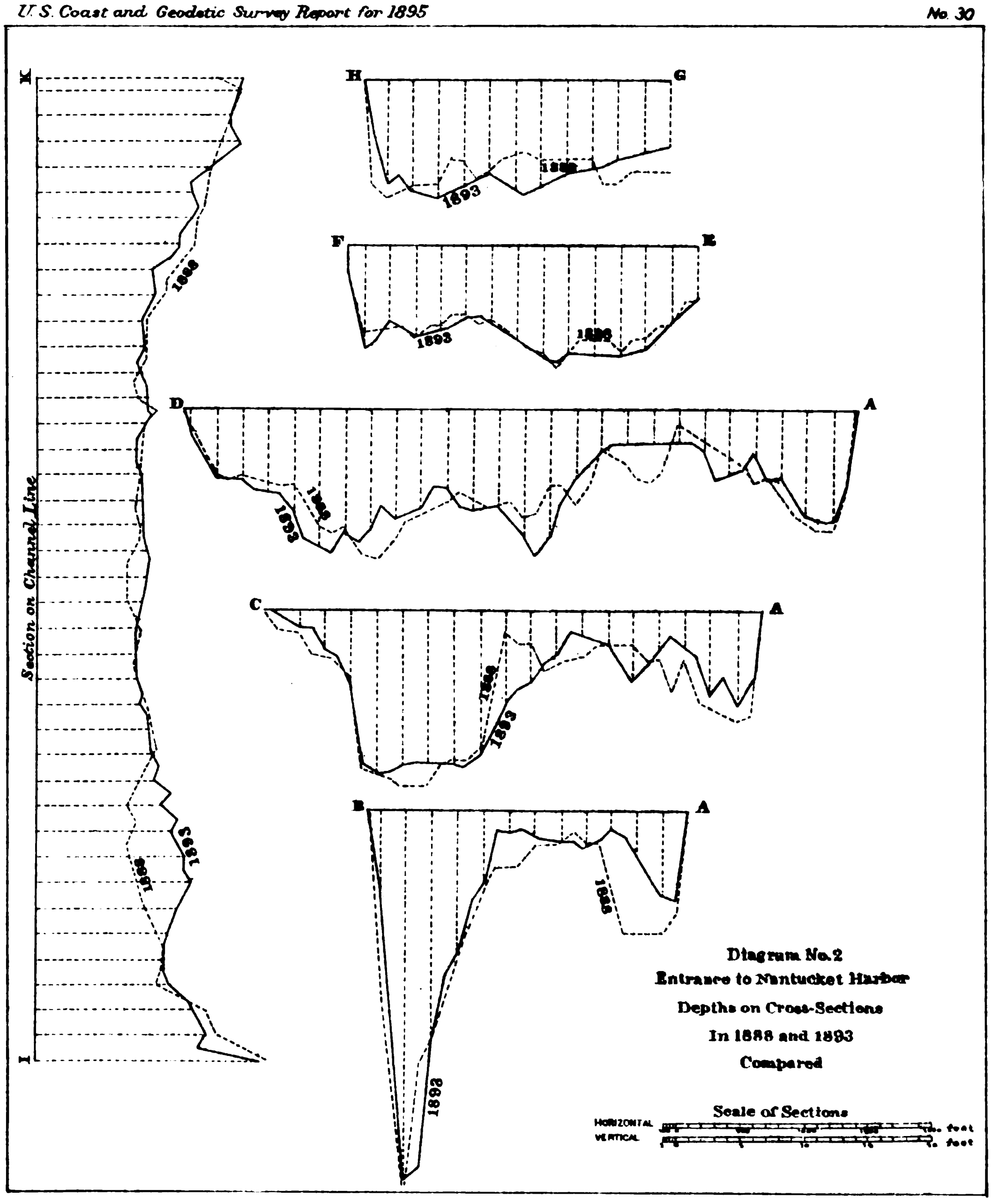
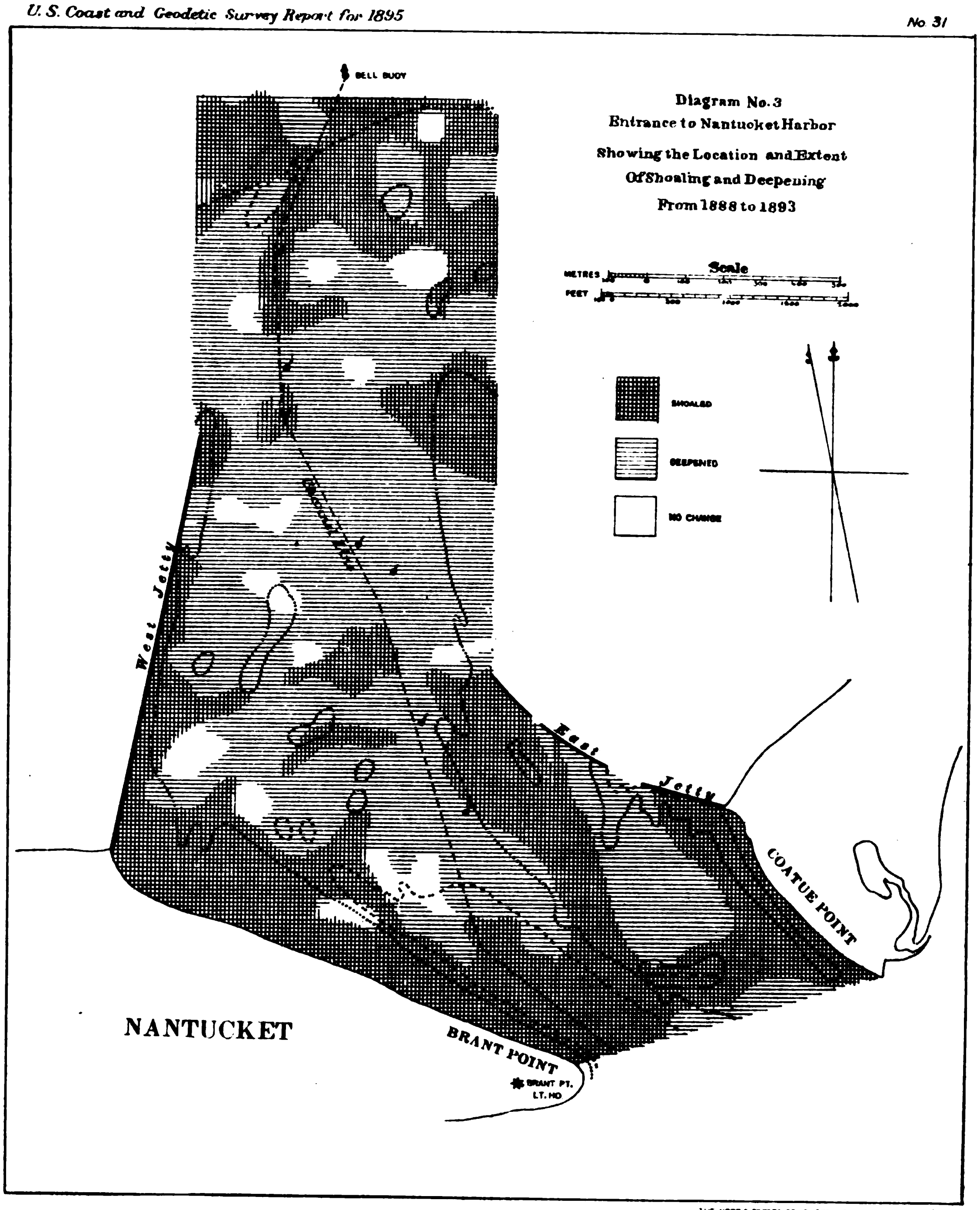


Diagram No. 2
Entrance to Nantucket Harbor
Depths on Cross-Sections
In 1888 and 1893
Compared



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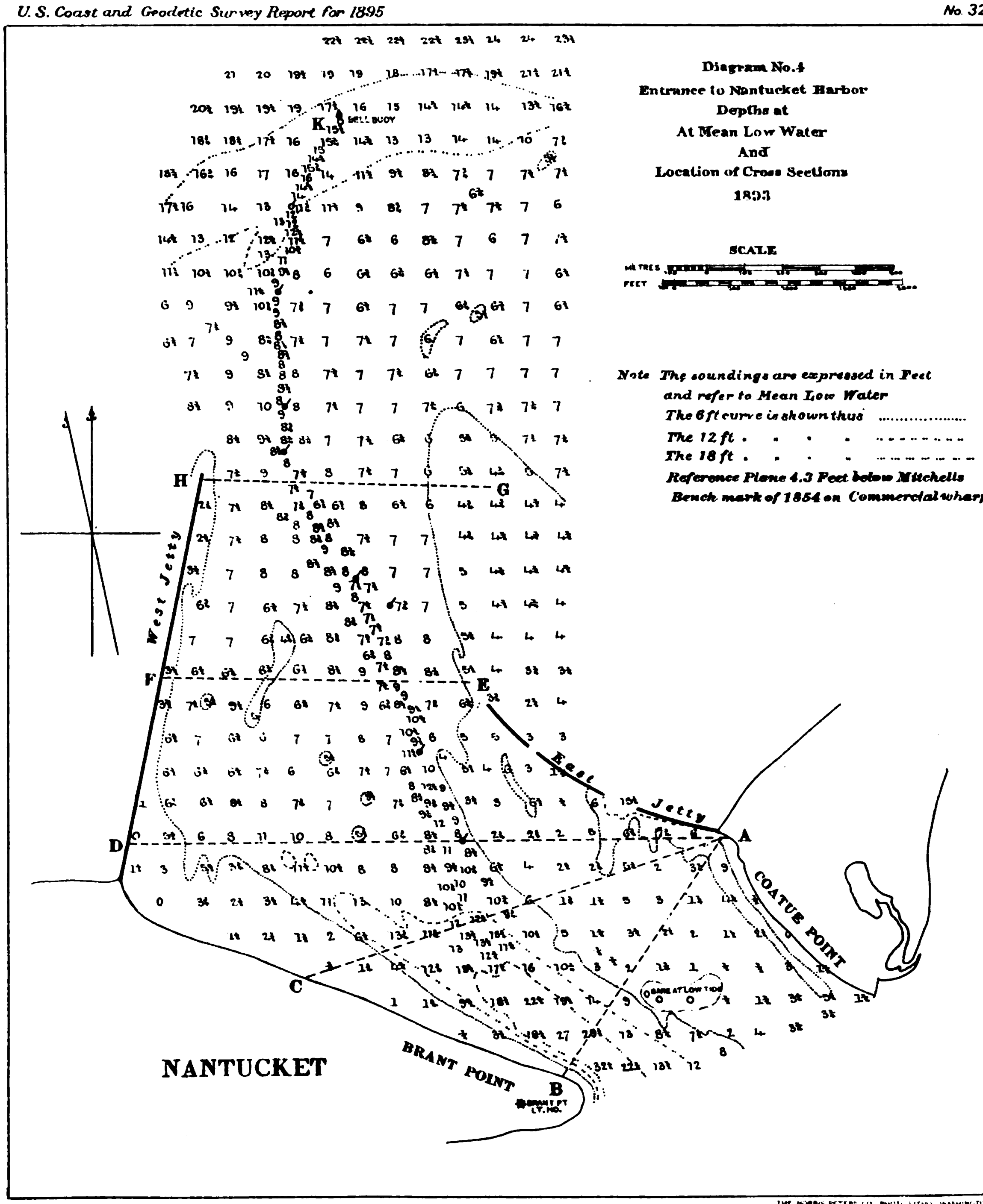

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APPENDIX No. 6.—1895.

NOTES ON THE SPECIFIC GRAVITY OF THE WATERS OF THE GULF OF MEXICO AND THE GULF STREAM.

By A. LINDENKOHL.

The sketch which accompanies this report and shows the specific gravity of the surface waters of the Gulf of Mexico and Gulf Stream is based on observations of temperature and density taken on board of the steamer *Blake* by Lieut. Commander C. D. Sigsbee between 1874 and 1878 while engaged upon the survey of the Gulf of Mexico, and those by Lieut. Commander J. R. Bartlett between 1878 and 1882 during an examination of the Gulf Stream and its approaches.

In conformity with the usage of the Challenger reports and the practice of the United States Fish Commission the specific gravity is given for a normal temperature of the sea water at 60°, taking the specific gravity of distilled water at the temperature of 39°·2 its maximum density, as unit.

It may be proper to remark that in the absence of sufficient data no attempt has been made to reduce the observations to an annual mean; but it is believed that very few abnormal observations have been recorded, that the ordinary changes of gravity are comprised within narrow limits, and that the sketch represents fairly well the average condition of things.

The specific gravity of the sea water is the result of the combined action of a number of physical factors, among the most prominent of which may be mentioned the winds, tides, ocean currents, evaporation, and precipitation. Each one of these factors exerts its influence in a peculiar way, and in order to determine in the final result the component part of each factor it becomes necessary to determine the absolute individual effect of each one.

WINDS.

The Gulf of Mexico lies fairly within the path of the northeast trades, and these may be considered as its predominating winds. But they do not blow with that steadiness and constancy of force and direction which are the characteristics of the trade winds in the open ocean; during the winter months they come from a nearly northern direction and during the summer months they veer from the north of east to the south of east. Maury in his Sailing Directions* attributes this deflection to rarification caused by the lands of northern Texas and the arid plains. It is generally held that in the middle of summer when the northeast trades, following the declination of the sun, attain their highest northern limit of about 35° latitude, the more powerful southeast trades cross the equator and reach the Gulf of Mexico through the Caribbean Sea.

The prevalence of northerly winds during the winter and southerly winds during the summer months must produce a derangement of level, an accumulation of water in the southern part of the Gulf during winter and a similar one in the northern part during summer. According to information collected by Lieutenant Pillsbury † there is a difference of about 0·7 foot between the

*Eighth edition, p. 986.

†U. S. C. and G. Survey Report for 1890, Appendix 10, p. 600.

mean levels of October and January in the northeastern part of the Gulf. The high level in October can not be attributed to excessive precipitation for the reason that this month is the driest one of the year along the northern coast of the Gulf. We shall see further on that this direct result of the mechanical action of the winds is quite insignificant when compared with the effect of their physical action on the waters of the Gulf by inciting a powerful evaporation.

EVAPORATION.

The Monthly Weather Review, published by the United States Signal Service, furnishes in the September number of 1888 estimates of evaporation for several stations on the Gulf: 51·6 inches annually for Key West, 48·8 for Pensacola, 45·4 for New Orleans, and 46 for Galveston. The average mean temperature of these four places is 70° or about the same as the mean annual temperature of the Gulf, hence the mean of the above figures which is 48 inches might be taken as the measure of annual evaporation of the Gulf as far as it is dependent upon temperatures. The evaporation from salt water, however, is less than that from fresh water and for this reason we might feel justified to assign a lower rate to the Gulf but for the counter effect of the winds. The figures of the Signal Service refer to the evaporation from the surface of ponds, rivers, reservoirs, and lakes near the signal stations. These surfaces are always to a greater or less extent protected against the action of the winds, besides the winds generally blow with greater force off-shore than on land. For these reasons we may expect an increased evaporation from the surface of the Gulf beyond that of its shores as far as it is influenced by the strength of the wind. Experiments with a Piche evaporator made by Prof. T. Russell* seem to indicate that at a velocity of the wind of 5 miles an hour, the evaporation is 2·2 times as great as in quiet air, at 10 miles 3·8 times, and at 15 miles 4·9 times. Colonel Abert,† who had given the matter of evaporation considerable study in connection with the planning of an extension of the Chesapeake and Ohio Canal to Baltimore, deduced the ratio between the evaporation in a laboratory and that of a canal to be as 1 to 1·44 and assumed 80·64 inches as the total amount of yearly evaporation in the latitude of the proposed canal. Captain Shufeldt in his Tehuantepec Canal Survey found the mean daily evaporation to be 0·016 foot on the isthmus, leaving the rainy days out of account. Assuming that the rainy season on the isthmus does not extend to any considerable distance into the Gulf and applying this daily rate to the whole year, we obtain an evaporation equal to 70 inches annually. From these various statements we conclude that an addition of 50 per cent to the amount of evaporation as deduced from the observation of the Signal Service on account of increased action of the winds might not be excessive, but in order to be within safe limits we will make the allowance but 25 per cent and assume the yearly evaporation for the whole Gulf to average 60 inches. With this condition and taking the area of the Gulf to contain 595 000 square miles‡ we find the mean amount of daily evaporation to be 1·54 cubic miles or 6·42 cubic kilometres.

PRECIPITATION.

The region bordering on the northern shore of the Gulf is noted for the great amount of rainfall which in the vicinity of New Orleans and Pensacola amounts to more than 60 inches per year and which within the limits of the United States is only exceeded by that on the Pacific Coast in Washington, Oregon, and northern California. There are rainy days in every month of the year. but the "rainy season" sets in with the summer months and lasts until October, which is the driest month of the year.

The central part of the Gulf is bordered on the southeast by the dry region of Yucatan and on the west by the arid zone of southern Texas and northern Mexico, hence it is concluded that here a very active evaporation will be going on nearly all the time and that there will be a very scant amount of precipitation.

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*Monthly Weather Review, September, 1888, p. 935: Average temperature during time of observations 83°·7 and relative humidity 50 per cent.

†Report in reference to the canal to connect the Chesapeake Canal with the city of Baltimore, by J. J. Abert, Colonel Topographical Engineers, 1838. Government Printing Office, 1874.

‡American Journal of Science, vol. 28, 1884, p. 320.

The climate of the coast region along the southern part of the Gulf is of a typical tropic character. The rainy season generally commences about the 10th of June and continues to November, and after this throughout the winter perhaps half the northers are accompanied with rain, and nearly all of them with cloudy weather.*

The mean yearly amount of rain for Vera Cruz is stated to be 179·4 inches.

If we extend the lines of equal evaporation from the positions which they occupy on the border of the Gulf, in conformity with the maps of the Weather Bureau and Schott's tables, across the Gulf according to the best of our judgment and compute the mean annual rainfall to be 32·7 inches, which is equivalent to 0·84 cubic miles or 3·51 cubic kilometres per day for the whole Gulf, we find that the precipitation is about equal to 55 per cent of the evaporation.

RIVER DISCHARGES INTO THE GULF.

The Mississippi River, which drains more than one-half of the area of the United States, constitutes the most important tributary of the Gulf of Mexico. Humphreys and Abbott in 1861 † estimated the annual discharge of the Mississippi at 19 400 000 000 000 cubic feet, which, expressed in a more convenient shape, amounts to about 0·36 cubic mile or 1·51 cubic kilometres per day. The Annual Report of the Chief Signal Officer for 1889 gives in Appendix 14 the total discharge of the Mississippi, including the Atchafalaya River, for the years 1881 and 1882 at respectively 154·54 and 202·71 cubic miles.

Taking the mean of these two statements, we find the outflow to amount to 0·49 cubic mile or 2·04 cubic kilometres per day. If we omit the arid regions of Texas, Mexico, and Yucatan from the area of the hydrographic basin of the Gulf, we find that the Mississippi River system occupies nearly three-fourths of this basin and that the drainage area of all the remaining rivers is equal to only about 40 per cent of that of the Mississippi. In the absence of discharge measurements of the numerous rivers which empty into the Gulf we may assume for the purpose of obtaining an approximate estimate that the discharges are proportional to the drainage area and upon that supposition obtain 0·196 cubic mile (0·816 cubic kilometre) for the mean daily discharge of these rivers. This added to the figures for the Mississippi gives a total daily gain to the waters of the Gulf by the discharge of rivers of 0·68 cubic mile or 2·86 cubic kilometres.

Recapitulating, we find that the Gulf loses on an average 1·54 cubic miles of water per day by evaporation and receives back in the same space of time 0·84 cubic mile by precipitation and 0·68 by river discharges, making a total of 1·52 cubic miles and showing an apparent loss of 0·02 cubic mile a day.

I do not claim for these figures such a degree of accuracy as would determine the existence and the amount of an excess of evaporation, but they are believed to be sufficiently close to show that precipitation and river discharges very nearly hold the balance to evaporation.

SPECIFIC GRAVITIES OF THE GULF OF MEXICO.

By computation I find the mean surface density of the Gulf to be 1·0277. This is 0·0006 more than Dr. Buchan in the Challenger reports allows to the eastern part of the Gulf. I have noticed that very generally the Challenger results give lower figures than those of the *Blake*. The observations on the *Blake* were made with Hilgard salinometers, and at this late date it is impossible to determine whether errors in graduation existed and had anything to do with these differences. The density observations of water from greater depths do not furnish very satisfactory results, probably for the reason that the hydrometer readings generally were taken while the water was in a state of transition from a low to a high temperature and that the temperature readings on account of the slow action of the thermometers can not be considered simultaneous with the corresponding hydrometer readings. The resulting densities of the bottom waters frequently are excessive, for the reason that the fall of the lead had stirred up the mud of the bottom and that some solid matter had found its way into the water cup.

It is assumed, however, that the vertical distribution of specific gravity in the Gulf conforms in general to the laws which govern that distribution in the open ocean, as they have been developed

* Tehuantepec Canal Survey, Capt. R. W. Shufeldt, 1872. Government Printing Office.

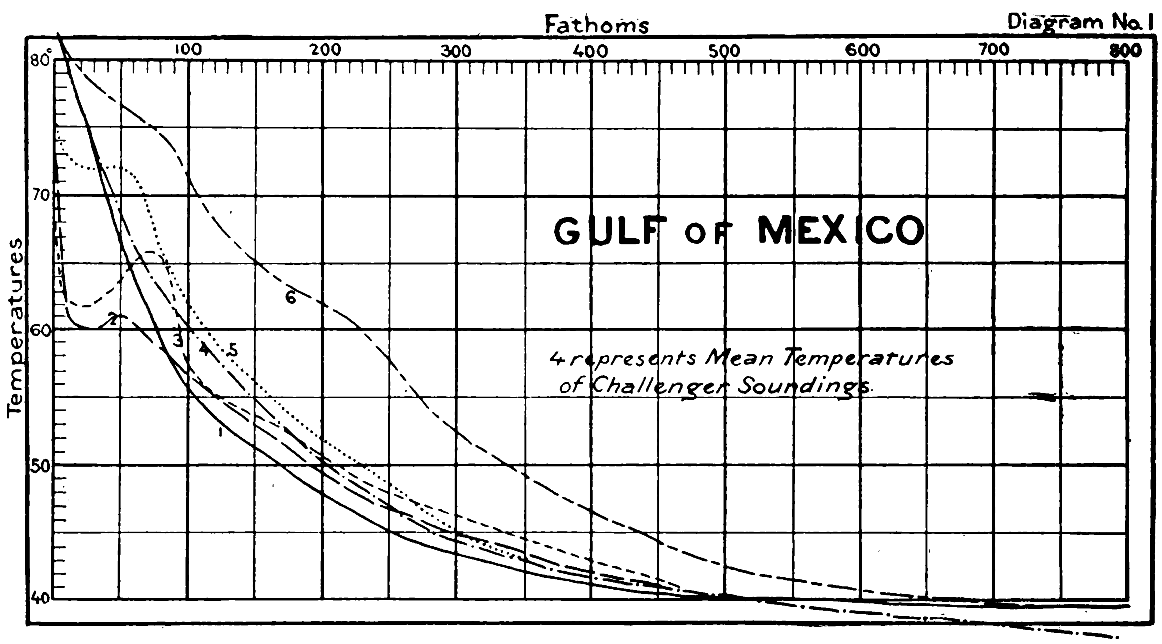
† Physics and Hydraulics of the Mississippi River, Phila., 1861.

by Mr. J. L. Buchanan, the chemist of the Challenger Expedition,* and accordingly I believe that there is a gradual diminution of specific gravity from the surface to the depth where the lowest temperature, 39½°, is reached, between 700 and 800 fathoms, and that from this depth to the bottom a gradual though very small increase takes place.

SPECIFIC GRAVITIES IN THE WESTERN PART OF THE GULF.

There is considerable difference in the behavior of fresh water which finds its way into the southwestern part of the Gulf from that which enters the northern part. It assimilates more readily with the sea water; by reason of its high temperature it remains at the surface and absorbs a sufficient quantity of salt to obtain the relatively high specific gravity of 1·028. In consequence of the constant drain of salt and heat which the waters below the surface experience, they show remarkably low gravities and temperatures.

The accompanying diagram shows by line 1 the temperature curve for a position in the southwest part of the Gulf, chosen at random, by line 3 that for a position in the northwest part, by line 6 one for the position in the southeast part, and finally by line 4 the mean temperature of



the sea at the different depths, taken from the report of Dr. Buchan on Oceanic circulation in one of the latest published Challenger volumes. It will be noticed that the temperatures in the southwest part of the Gulf are from 4° to 2° below the mean temperatures of the sea between the depths of 100 to 400 fathoms, that within this range they are a few degrees below those of the northwest part. But all these temperatures—those in the western part of the Gulf and the mean sea temperatures—are greatly surpassed by those in the eastern part of the Gulf. The difference commences at the surface, increases with the depth until at 250 fathoms it amounts to about 18°, thence it decreases until at about the depth of 700 fathoms the minimum temperature of 39½° is reached throughout the Gulf.

The fresh water which enters the northern part of the Gulf preserves its autonomy for a much longer time and greater distance from the coast than that in the southwest part. It also floats on the surface, but this is on account of its lightness or poverty of salt and rather in spite of its temperature. In its progress toward the middle of the Gulf it constantly receives accessions to its temperature and salinity from the supply of the Gulf at its greatest depths until the maximum of heat and saltness are transferred to the surface. In the accompanying diagram the blue and the

*On the distribution of salt in the ocean, as indicated by the specific gravity of its waters. Journal R. Geog. Soc., 1877.

dotted curves, which refer to positions in the northwest and northeast part of the Gulf respectively, are types of a peculiar shape which is frequently met with in the northern part of the Gulf, and which, according to the observations made by the Fish Commission and the Coast Survey at the suggestion of Professor Libbey, is normal for the left bank or cold wall of the Gulf Stream from Long Island to Nantucket. These curves show the existence of a layer of light and cold water on the surface, reaching to the depth of between 50 and 100 fathoms and the maximum of density below the cold layer. The temperature curve, given by a broken line, indicates the shape which is peculiar to the vertical distribution of heat at a greater distance from the coast or in the central part of the Gulf. The peculiar feature of a region of low temperatures less than 45° at the depth of 250 fathoms, which is shown on Sketch B to stretch through the middle of the western Gulf from the southern end to about halfway between the Mississippi Delta and Yucatan, is no doubt to be attributed to the continuous transfer of heat toward the surface.

Concerning the vertical distribution of salinity we infer from the temperature curves that in the central and southern parts of the Gulf it decreases from the surface downward until in the western part the limit of about 1·027 and in the eastern part the limit of about 1·028 is reached. In the northern part of the Gulf, leaving the immediate coast region out of consideration, the maximum of gravity is generally found at a depth of from 25 to 100 fathoms, thence the usual decrease with increasing depth to the limit of 1·027 or from the maximum below the surface downward until at about the depth of 800 fathoms the minimum temperature of 39½° is reached. From this depth to the bottom the temperature remains constant, but it is supposed that a slight increase of gravity takes place, similar to that which has been found to exist in the ocean.

The persistence with which the salt water follows up the tracks of the fresh water to its very sources, as is shown by the existence of water of the respectable density of 1·0177 very close to the northern shore of the Gulf and under the very mouth of the Mississippi, can not be attributed solely to energy of force generated by difference of temperature and density between the waters of the Gulf and the fresh river or rain water. We have abundant proof of the fact, which has also repeatedly been mathematically demonstrated, that such differences can only produce a very sluggish motion.* But we recognize in this energy the aggressiveness of the tidal flood current which works along the bottom of the sea and attacks the currents it meets from the flanks and bottom with increasing persistence until they are completely reversed. It is safe to assume that but for the tide in connection with the shoal bottoms along the northern shore of the Gulf, we would not find such high specific gravities as from 1·021 to 1·0267 in the bays along this shore.

TRACK OF THE MISSISSIPPI RIVER WATER IN THE GULF.

It will be noticed by an inspection of Sketch A showing the specific gravities that the fresh water which is carried into the Gulf by the Mississippi does not continue the course of its initial direction on entering the Gulf, but is deflected to the westward to such an extent that it finally reaches the middle of the western half of the Gulf, instead of making its way straight from the Passes to the Strait of Florida according to the popular supposition. This deflection to the right is quite in accordance with the observations of the engineers engaged upon the jetties of the South Pass who report a decided inclination of the sediment of the river toward deposition on the west side of the Pass. Three different explanations may be advanced to account for this fact. The rotation of the earth has the same effect upon a current of water flowing from a higher to a lower latitude that it has on an atmospheric current under similar conditions, as the trade winds, for instance, and deflect it to the right. This deflection, however, can be but very slight, owing to the smallness of the changes of the arcs of parallel in the latitude of the northern part of the Gulf; it might possibly be an auxiliary cause, but could not be the principal one. The deflection might possibly be ascribed to the effect of the prevailing winds. Although the winds throughout the year have an easterly tendency, they are far from showing the constancy and steadiness which would be necessary to produce the uniformity and consistency in the deflection shown to exist by the observations. It certainly must have happened during the time of observations that there was a lull or even a reversal of the wind, but the observations fail to show a disposition of the

* Handbuch der Oceanographie, Boguslawski and Krümmel, vol. 2, p. 286 et seq.

water to file off to the left. We shall see later on that the Strait of Yucatan throws a volume of water into the Gulf sufficient to raise its level 5¾ feet in twenty-four hours; we have also reason to believe that this current generally has the control over the eastern part of the Gulf and also tries to gain that over the western part by pushing a large volume of water along the Yucatan banks. Under these conditions the western or northwestern part of the Gulf presents itself as the most inviting field for the entrance of the Mississippi, the more so for the reason that the excess of evaporation over precipitation will have a constant tendency to create a depression in the central part of the western Gulf.

SPECIFIC GRAVITIES IN THE EASTERN PART OF THE GULF.

We have seen that the waters of the Gulf constantly gain in heat and salt on their way to the middle of the Gulf. From here they may sometimes be turned back by the winds and currents, but in general they proceed in an easterly direction against the trade winds toward the Strait of Florida. This motion "against the wind" produces a very active evaporation by which the specific gravity of the surface waters is soon increased beyond the limit of their ability to keep afloat. Descending, they carry down with them a greater amount of salt and heat than could reach remote depths in any other way, either by radiation or transmission by contact. Sketch B, which gives the isothermals at the depth of 250 fathoms, shows that the highest temperatures above 60° are to be found at that depth in that part of the Gulf which lies to the northward of the Strait of Yucatan and to the westward of the Strait of Florida. It is in this locality then that we assume the process of a descending warm current to be going on with the greatest precision and intensity. A careful study of the distribution of temperature at the different depths of the ocean, a study which can be made by any one by consulting the isothermal charts of the last issued volume of the Challenger Expedition, shows that whenever by excessive evaporation the temperature and specific gravity of a part of the ocean or dependency of the ocean, like the Red Sea, is raised considerably above that of the ocean, a system of circulation is found to exist by which a transition of temperatures and densities is effected, which circulation proceeds from the greater depths toward the surface and reaches out laterally to great distances, as in the case of the Mediterranean and Red Seas, more than half way across the Atlantic and Indian oceans, respectively. At this same depth of 250 fathoms where we find temperatures of above 60° in the eastern Gulf, we find temperatures as low as 44° in the western part and 47° in the Caribbean. Hence it is assumed that two systems of undercurrents have their origin in the eastern Gulf; one proceeding westward and supplying the western part of the Gulf with heat and salt and the other passing through Yucatan Channel into the Caribbean freighted with a supply of salt to the diluted waters of this sea. The lowest temperature found to exist in the Florida and Old Bahama channels at the depth of 250 fathoms is 58° or only a few degrees less than that in the eastern Gulf and in the Atlantic off the Bahama Islands. There apparently exists no necessity for any undercurrents between the Atlantic and Gulf, and it is a significant fact that the depth in the shoalest part of the passages to the Gulf is not more than sufficient to accommodate existing surface currents. We are prepared to look for a high specific gravity at these depths in the southeastern Gulf corresponding to the high temperatures. The observations give 1·0280; this is fully 0·001 more than the Challenger Expedition gives for the North Atlantic at corresponding latitudes and depths, but for reasons already stated I can not assume full responsibility for these figures.

SPECIFIC GRAVITIES OFF THE CAMPECHE AND FLORIDA BANKS.

If a body of warm water at any depth below the surface loses part of its heat and salt by contact with colder water, the increase of its density by shrinkage in consequence of loss of heat always exceeds the decrease by loss of salt. The warm water thus becoming heavier sinks to greater depths. If it then happens that the warm water touches bottom, as is the case at the foot of the slopes of the two great banks of the Gulf, the Campeche and Florida banks, and can

sink no further, it finds relief of its excess in weight by another process, which it is believed can best be explained with the assistance of the subjoined table:

Density of standard sea water at different temperatures.

(T)	Density of standard sea water.	ΔD for 1°	$\Delta^2 D$	ΔP	$\Delta^2 P$
80°	1·02300	17·2		23·2	
			0·9		1·1
75°	1·02383	16·3		22·1	
			1·0		1·4
70°	1·02461	15·3		20·7	
			1·0		1·6
65°	1·02533	14·3		19·1	
			1·4		1·7
60°	1·02600	1·29		17·4	
			1·5		2·0
55°	1·02658	12·4		15·4	
			1·6		2·2
50°	1·02710	9·8		13·2	
			1·8		2·3
45°	1·02752	8·0		10·9	
			1·9		2·6
40°	1·02785	6·1		8·3	

The first column gives temperatures decreasing 5° successively, arranged in the order in which they follow with descending depth. The second column contains the corresponding densities of standard sea water which has the density of 1·026 at 60° F. These densities have been obtained by interpolation from those given by Professor Dittmar in the first volume of the Challenger reports. The third column gives the increase of density corresponding to the decrease of temperature of 1° for each temperature. The fourth column gives the successive differences of these increases. The fifth and sixth columns furnish the equivalents of salinity to the figures of the third and fourth columns respectively. All figures in the last four columns represent thousandths or have been multiplied by 1 000.

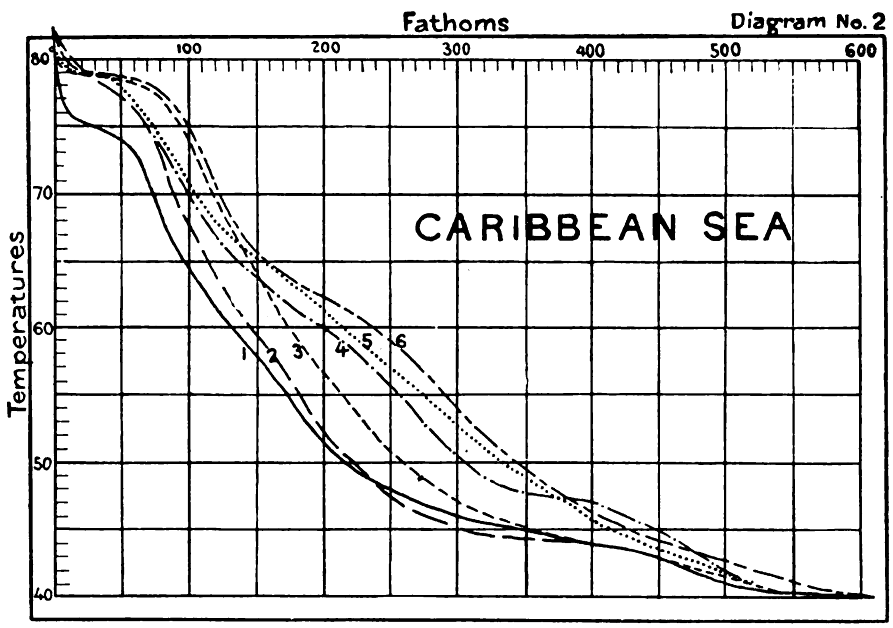
It will be noticed that the rate of expansion of sea water or the coefficient of expansion grows larger with increase of temperature, but that the equivalent of salinity is proportional to the density ($P=\frac{(S\,15^{\circ}\cdot 56-1)}{4^{\circ}}\,1353$).

Now, if I suppose 1° of heat to be transferred from the lowest layer to the next one above, from 40° to 45°, the conditions of equilibrium require that with this transfer of heat 2·6 per mille more salt than constitutes an equivalent should be transferred from the lowest layer. By this operation the salinity of the lowest layer will therefore be reduced by 2·6 per mille and its density by 1·9 per mille. This decrease of density serves as an effect for the increase by the transmission of heat to adjoining colder water. Assuming the contact of warmer and colder water to extend from the bottom to the surface there will be a tendency toward increased density through the entire depth of the warm water, and in consequence a shifting of heat and salt at every depth to a higher level with the effect of neutralizing this tendency. That a motion similar to the one described really takes place on the edges of shoals where warm and cold waters meet is shown by the low temperatures at the greater depths, and the accumulation of heat and salt at the surface off the Campeche, Florida, and Bahama banks, but above all in the Gulf Stream off the continental shelf, as will be referred to again later on.

It yet remains to be mentioned that the change of temperature with depth is not by steps, but continuous, and if we assume density or the equivalent of salinity either to be a function of temperature ($D=fT$) and the change of temperature to be infinitesimal instead of 1°, the figures of the third column, which represents $\frac{\Delta F}{\Delta T}$ will become $\frac{dfT}{dT}$; those of the fourth, $\frac{\Delta^2 D}{\Delta T^2}$, will become $\frac{d^2 fT}{dT^2}$. In short, the first differential coefficient will measure the quantity of salt in motion and the second differential coefficient the quantity of salt which is neutralized by this motion.

THE YUCATAN CHANNEL.

The current which passes from the Caribbean Sea to the Gulf of Mexico through the Yucatan Channel is the strongest one met with by the *Blake* within the Gulf Stream region during a period of over seventeen years' engagement in surveys and explorations. It occupies nearly the entire width of the passage between Cape Catouche and Cape San Antonio, but develops its greatest strength from 2·5 to 5 miles on the western edge, close to the slope by which the Campeche banks descend to the basin of the Gulf. According to the serial current observations taken by Lieutenant Pillsbury in 1887 at 11 stations and to the depth of 130 fathoms, the velocity decreases rapidly with increasing depth and may be assumed as zero at the depth of about 200 fathoms. A calculation of the volume of water which passes through this channel in twenty four hours, based upon these observations, gives the enormous quantity of 652 cubic miles or 2 717 cubic kilometres, which is sufficient to raise the level of the whole Gulf 5¾ feet within the same length of time. From the observations which were taken by the same officer in the same year across the Strait of Florida, about 10 miles to the westward of Havana, we compute the volume of the water which passes through the Strait of Florida to the Atlantic within twenty-four hours at about 432 cubic miles or 1 800 cubic kilometres. Hence it appears that only about 66 per cent of the quantity of water

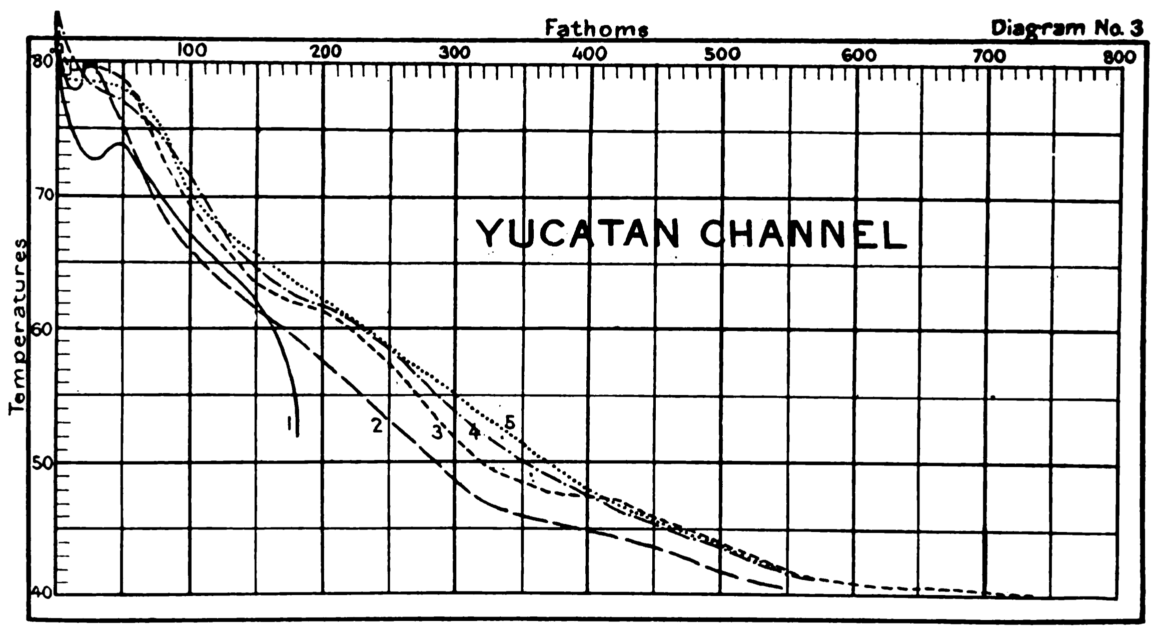


which enters the Gulf through the Yucatan Channel is carried off by the Gulf Stream. Making all possible allowances for water which may pass from the Gulf to the strait, by the passages around Florida Keys, for the existence of abnormal conditions during the time of observations, and for errors of observation and computation, we find this deficit of 34 per cent can not be very materially reduced, certainly not below 25 per cent. Wherever heretofore the question of difference of volume between the waters passing through the Yucatan Channel and the Gulf Stream has been raised, it has been done vaguely, and answered just as vaguely by the assertion that evaporation would carry off any possible excess. When we reflect that the Yucatan Channel current develops sufficient strength to raise the level of the whole Gulf 5¾ feet within one day, and that we do not expect evaporation to accomplish more than to depress the level about one-sixth of an inch during the same length of time, we see that evaporation is utterly powerless to neutralize the effect of the Yucatan Channel current, and we have no option left but to assume that the bulk of the volume of water which finds no escape through the Gulf Stream returns to the Caribbean Sea by an undercurrent similar to that which has been proved by Dr. Carpenter to exist in the Strait of Gibraltar and passes from the Mediterranean to the Atlantic.

Under the supposition that the difference of level between the Caribbean and the Gulf, which

produces the current in the connecting channel, was solely caused by the winds, there would be no necessity for an undercurrent, but if we assume this difference of level to be entirely due to the differences of temperature and density between the waters of the two seas, there would be an absolute necessity for an undercurrent by which a body of water of very nearly the volume of the surface current would be returned to the Caribbean. (The volume of the subcurrent would be less by not quite 1 per cent, on account of the difference of temperature density, compression by pressure, and unequal absorption of gases.) From the ratio of the two currents, the Yucatan Channel current and the Gulf Stream, as it has been established by the observations cited, we conclude that the difference of level between the Caribbean and Gulf is mainly due to the winds, but that the current which passes from the first to the latter is greatly strengthened by the differences in temperature and salinity, and finally that, provided that the winds did not affect the level of the Caribbean, there still would be a surface current into the Gulf, though greatly reduced in strength, just as there is one from the Atlantic to the Mediterranean.

There are only density observations of surface water available for the Caribbean, and an examination of the temperature curves affords the only clew to the vertical distribution of heat and salt in that sea. We notice in the central part of the northwestern Caribbean a deep surface stratum



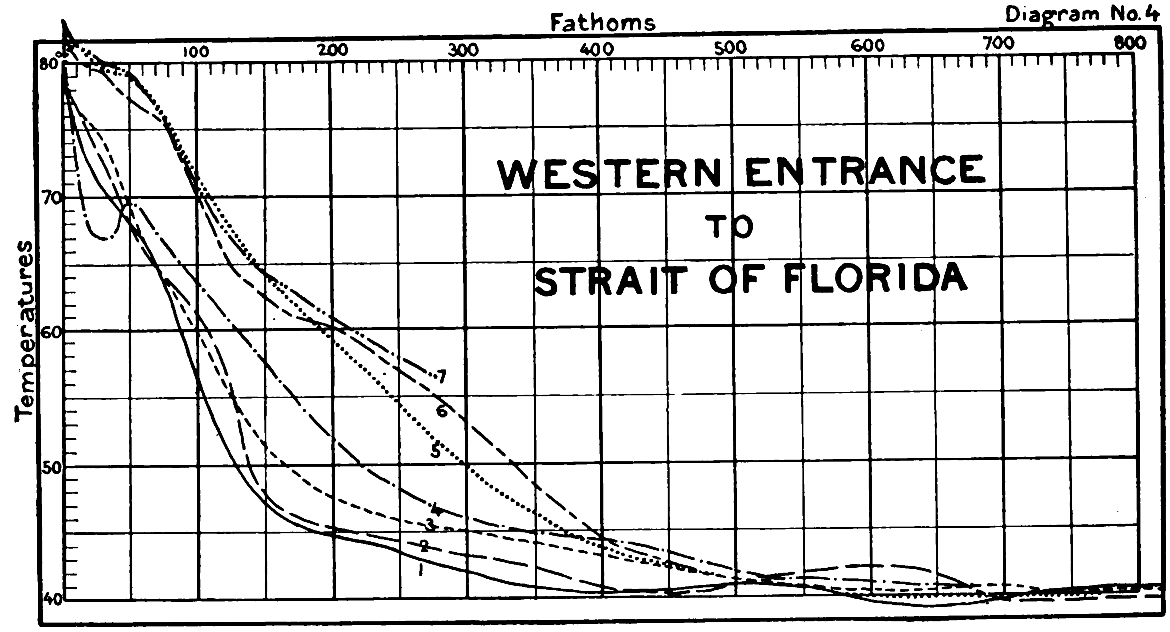
of warm water, water of an even temperature of 78° to 80°, reaching to the depth of 50 to 75 fathoms; beyond these depths the usual decline of heat takes place. From this arrangement of temperatures we conclude that the maximum density is not to be looked for at the surface, but at a depth of between 50 and 75 fathoms, and that from these depths downward the decrease is similar to that which in the central and southwestern Gulf commences at the surface. In the vicinity of the coast of the Central American Main, high temperatures are confined to the surface; at a depth of 10 fathoms there is already a decrease of 5°, and the difference in the temperature between the waters near the coast and those farther off increases with the depth until at 250 fathoms it reaches 12°, indicating a difference in specific gravity of about 0·0015. From this depth onward the difference decreases until at a depth of 600 fathoms the temperature is uniformly found to be 40°. This disposition of the temperatures shows that the waters of the northwestern Caribbean are subjected to a heavy dilution which proceeds from the direction of the mainland and reaches downward to the depth of 600 fathoms. By examining the temperature curves of the Yucatan Channel we see that the thick stratum of warm surface water has disappeared, that during its progress to this channel a sufficient amount of salt and heat have been transferred to the surface to displace the maximum of density from the depth of 75 fathoms to the surface. There is yet a considerable body of cold

water on the Yucatan side of the channel, but a gain of 6° temperature at the depth of 250 fathoms is to be recorded.

This disposition of temperatures in the Caribbean Sea is entirely in accordance with the views expressed concerning the existence of an undercurrent from the Gulf of Mexico. It is supposed that the warm and slightly saline water of the Gulf passes in a southwesterly direction through the Yucatan Channel, and becoming heavier from the loss of heat, and in spite of the loss of salt, sinks down consecutively to greater depths, and that the liberated heat and salt by a system of successive transfers find their way back to the Gulf with the surface current.

CURRENTS IN THE GULF OF MEXICO.

The current of the Yucatan Channel, by spreading and thinning out, soon loses its strength after leaving the strait At a distance of 100 miles its velocity is reduced to 1½ miles. The only place at a greater distance where it continues to show considerable vitality is at the northeastern edge of the Campeche bank, about 250 miles to the northward of Cape Catoche, where velocities

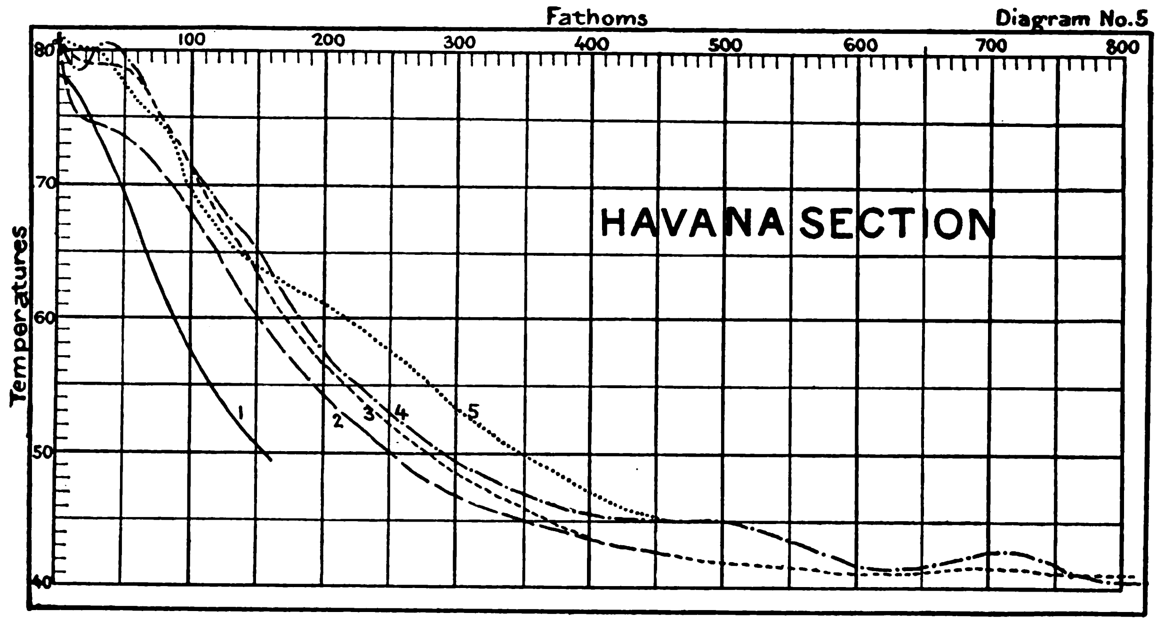


of 2½ miles have been recorded. These observations presumably indicate a strong effort of the current to reach the western Gulf by the shortest route.

The current observations made by Lieutenant Vreeland in the years 1889-1891 for the purpose of tracing the connection of the Yucatan Channel current with the Gulf Stream and to follow up the course of the first-named current through the Gulf, have been productive of rather more negative than positive results. It was found that at the entrance to the Strait of Florida, the current was generally from the direction of the Gulf, but sometimes it headed from the Yucatan Channel. By occupying twelve different stations between the Campeche banks and the Mississippi Delta, it was ascertained that farther west no permanent conditions existed, but that the currents were very irregular and sometimes completely reversed. I have carefully gone over Lieutenant Vreeland's observations and do not find any apparent inconsistencies that could not be easily explained. The Gulf of Mexico serves as a sort of a receiving reservoir for the waters which pass through the Yucatan Channel. When the current of the channel works with full energy it spreads in every direction between the Campeche bank and the north shore of Cuba. It invades the Florida Strait, but does not devote any special attention to it. Its main object appears to be to gain control of the whole Gulf by moving against its center with the greatest force that can be concentrated. When these conditions prevail the current is supposed to hold the waters of the whole Gulf in check and raise their level several feet above that of the Atlantic. At such times

the waters of the Gulf Stream consist for the smaller part of those directly transferred from the Yucatan Channel, but more essentially of those which are forced into the Strait of Florida by the hydrostatic pressure from the Gulf. But we have seen that the current of the Yucatan Channel does not always work at high pressure, that it is very changeable, and sometimes falls off as much as 50 per cent. Whenever this is the case the pent-up waters of the Gulf are everywhere set into motion toward the Strait of Florida, and not only force the Yucatan stream through these straits but follow it up to the Yucatan passage, attack it in its eastern flank, which is the weakest part, and actually force part of it back into the Caribbean Sea. This is no doubt the cause of the persistent southerly current which Lieutenant Pillsbury has noticed to exist near Cape San Antonio.* Now we can also understand why to the westward of the Florida Bank we should at times find a strong current from the southward, indicating a powerful action of the Caribbean current, and again at another time a still stronger current from the northward, caused by waters which in consequence of reaction of the Gulf are on their way to the Strait of Florida.

Summing up we find that the time-honored theory, according to which the Gulf Stream has its origin in the Yucatan Channel, but makes the detour of the entire border of the Gulf before entering the Strait of Florida, has to be abandoned. But we also find that the theory which super-



seded the one just mentioned, and according to which the Gulf Stream made directly from the Yucatan Channel to the Strait of Florida, is not substantiated by facts. Another theory makes the mouths of the Mississippi the fountain head of the Gulf Stream; this theory is, as far as I can see, even much wider of the mark than any other that has been suggested.

The Gulf Stream as an appreciable and permanent current, or the Gulf Stream proper, commences, as has been shown by Lieutenant Pillsbury, at the extreme western entrance to the Strait of Florida.

THE GULF STREAM IN THE STRAIT OF FLORIDA.

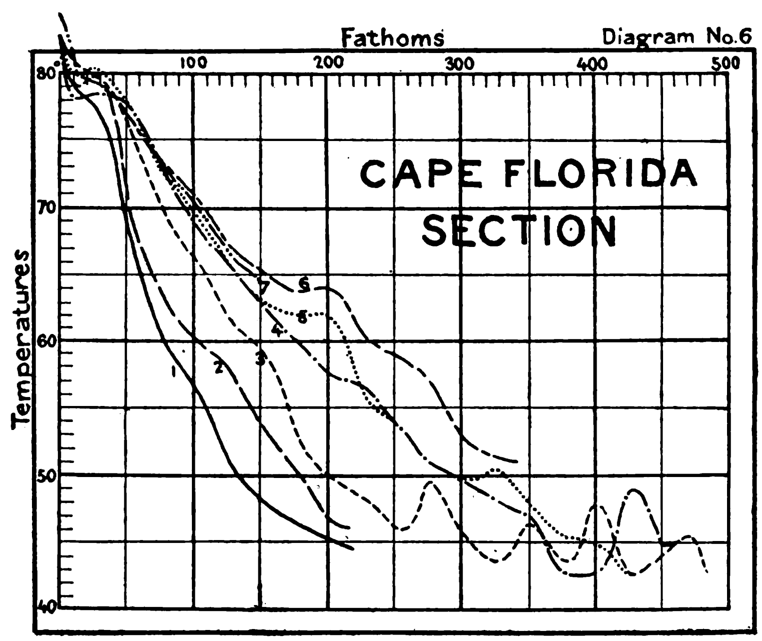
According to the observations by Lieutenants Pillsbury and Vreeland the Gulf Stream is a weak current, less than 2 miles per hour at the commencement of its career, and hugs the Florida banks quite closely. During the first 100 miles of its progress it shifts over to the southern side of the strait, practically retreats from the Florida banks, but makes considerable gain in strength; mean surface velocity, about $2\frac{1}{2}$ miles.

The temperature curves for the western entrance of the strait show that the cold water which

* Appendix No. 10, U. S. C. & G. Survey, Report for 1890, p. 534.

descends from the Florida banks reaches halfway across the strait and that the warm water is all concentrated near the Cuban shore. At the depth of 150 fathoms we find differences of 17° between the temperature of the cold water in the northern and warm water in the southern half of the strait, which is a much greater difference than any noted in the Caribbean Sea.

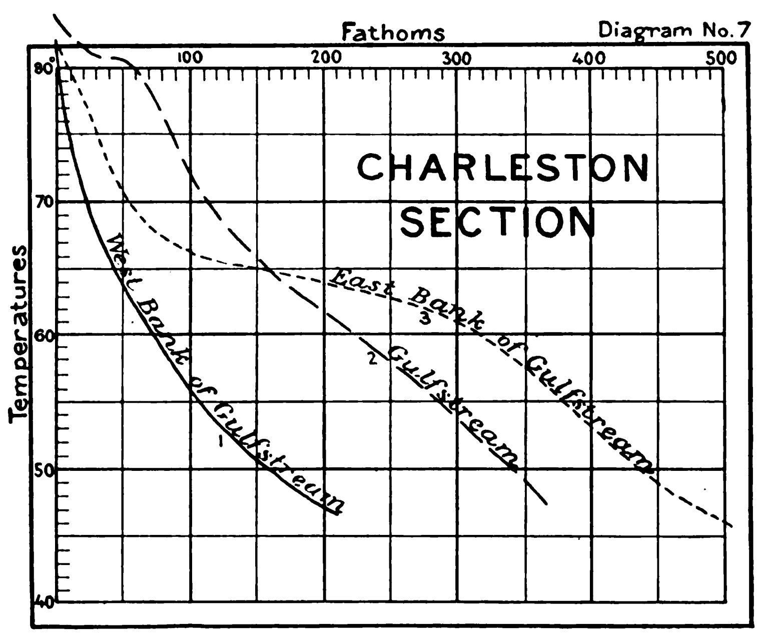
In consequence of these differences a lively exchange of temperatures must go on in the greater depths, and in conformity with this supposition we find already in the Havana cross section the extremely cold water confined to the vicinity of the Florida Reefs, and only a few degrees difference at any depth between the water about the middle of the strait and the accumulation of warm water of the Cuban coast, excepting the water directly under the surface to 80 fathoms depth, where there still exist differences of about 5°. The current observations, which were carried on to a depth of 130 fathoms, indicate a much greater depth of the Gulf Stream opposite Habana than was conceded to the current on the Yucatan Channel, as much as 500 fathoms against 200. From the distribution of temperatures in the vicinity of the Florida Strait it is inferred, as has already been stated, that there are no marked undercurrents in existence in this strait. The feeble undercurrent flowing in a westerly direction, which the current observations appear to indicate to the northward of the Gulf Stream, is probably of tidal origin. The flood current is sup-



posed to cross the reefs from the direction of the strait, and the ebb current to pass over the reefs from the Gulf. The ever-changing strength and direction of the tidal current, in connection with the varying strength of the Gulf Stream and the uncertainties of the winds, will produce all kinds of currents, which it will be difficult to analyze. But here on the very threshold of the Gulf Stream we find a condition of things which is calculated to upset all our preconceived opinions of the Gulf Stream based on the popular belief, as it finds expression not merely in the text-books of geography, but also in the most respectable works of physical geography. Almost everything connected with the Gulf Stream has been a matter of controversy, and if there existed any one property or qualification of this stream upon which all opinions agreed it was this, that it carried such an immense amount of heat over from the Gulf of Mexico toward the shores of Europe as to very materially ameliorate the climate of the whole of western Europe. Now, instead of finding the Gulf Stream well equipped on starting on its long journey with an inexhaustible supply of salt and heat, we find that it actually does not start out with so much of these commodities as can be picked up anywhere in the Atlantic between Bermuda and the West Indies, or Southern States; moreover, it carries the best part of its supplies on its surface, where by diffusion and dilution they are liable to be soon dissipated. In consequence we are not greatly surprised to find that the

Gulf Stream's stock of trade, heat and salt, has nearly given out by the time it reaches Cape Florida.

The cold water in the western half of the strait opposite Cape Florida reaches nearly to the surface, and at the depth of 250 fathoms, with temperatures ranging from 46° to 54°, stretches nearly across the entire width of the strait. The specific gravity, in consequence of the afflux of cold water, has gone down below 1·0280. Luckily for the Gulf Stream succor is at hand. A stream of warm and highly saline water, which has been moving up from the Old Bahama Channel through the Santarem Channel close to the great Bahama Bank, is ready to join the Gulf Stream and restore the temperature and specific gravity of its eastern edge, near the Bemini Islands, fully up to the Habana standard. The strongest current or the axis of the Gulf Stream is quite close to Cape Florida (about 15 miles away), over a depth of about 250 fathoms, with a bottom temperature of 34°. Here is about the nearest approach to land and the least depth of water and the strongest current of from 3 to 4½ miles in the course of the Gulf Stream. According to a diagram (No. 51) which accompanies Lieutenant Pillsbury's report on the Gulf Stream (Report of 1891, Appendix 10) the Gulf Stream current nearly everywhere in the Cape Florida section reaches within a short distance of the bottom, and with its eastern flank at a depth of 350 fathoms and with a velocity



of about 1½ miles apparently scrapes the bottom. The temperature curves display an irregularity near the bottom of the strait which at these depths is something very unusual, and reveals a strange state of commotion. This state is supposed to be produced by an encounter between the cold waters which have descended from the Florida reefs with the warm water moving up from the Santarem Channel. We infer from these curves that the strength of the Florida current, which enables it to undermine the Gulf Stream and spread low temperatures halfway across the strait, has departed, and that henceforth this office must be attended to by currents which come from a more northern latitude and move along the Atlantic border of the United States.

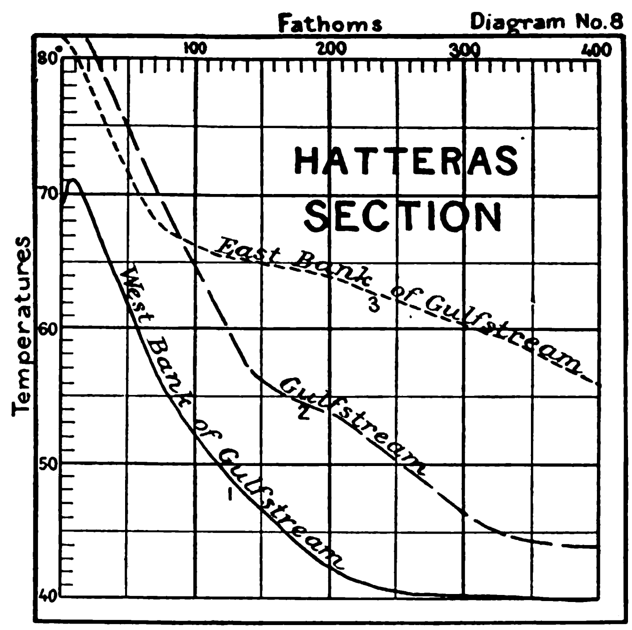
THE GULF STREAM BETWEEN CAPES FLORIDA AND HATTERAS.

The temperature curves given for the Charleston and Cape Hatteras section show certain peculiarities which are common to all sections of the Gulf Stream examined by the Coast Survey, including those in the Florida Strait and also the Yucatan Channel. They are also noticeable in the Challenger cross sections of the Gulf Stream from the Bermudas to New York and from Halifax to the Bermudas. These peculiarities include the existence of a body of very cold and

light water to the left of the Gulf Stream. The Gulf Stream itself generally is several degrees warmer at the surface than the adjoining water of the ocean, but the great heat of the Gulf Stream is confined to a superficial stratum; below the depth of 150 fathoms it is actually a great deal colder than the ocean to its right. Sketch B shows the temperature of the belt of cold water which skirts the Atlantic coast of the Southern States to be about 45° at the depth of 250 fathoms. At the same depth we find the ocean all the way to the Bermudas to be possessed of the very uniform temperatures of from 60° to 65°. The isothermal of 60° is found to be about 40 miles to the eastward of that of 45° and within this distance of 40 miles the transition of temperatures from 60° to 45° is effected.

In conformity with the views expressed when speaking of the specific gravity of the water off the Florida and Campeche banks the transition of temperatures has a tendency to increase the density of the warm water.

The preservation of density implies the liberation of part of the salt and heat. The heat and salt set free will rise vertically until they reach the surface. This process is assumed to be going on along the whole length of the continental slope from Canaveral to Hatteras throughout the whole breadth of 40 miles in which the transition of temperature is accomplished, and to produce,



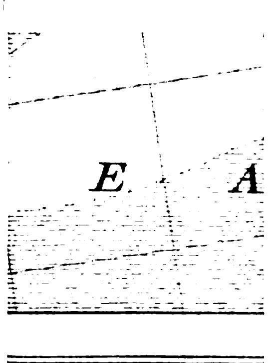
by accumulation of salt and heat on the surface of the ocean, the phenomenon known as the Gulf Stream.

The theory upon which the warmth of the waters of the middle North Atlantic between the depths of 100 and 600 fathoms generally is accounted for is no doubt correct. A very active evaporation, produced by the dry and steady trade winds, causes the surface waters to sink and carry down a great amount of heat and salt, in the manner already described for the eastern part of the Gulf, with the difference, however, that in the Gulf the process is restricted to a very small area, while on the Atlantic it takes place over the wide expanse of the sea.

It has been mentioned that the Gulf Stream as a carrier of heat and salt receives a very timely addition to its stock when opposite Cape Florida, but far more abundant supplies have been accumulating near the northern entrance to the Strait of Florida waiting for the arrival of the Gulf Stream. We can do no better than quote from the report of Lieutenant Pillsbury, already frequently referred to, to account for the presence of these warm and highly saline waters to the northward of the Florida Strait: "There is another body of water to the northward of the West India Islands, which, driven by the trade winds, is moving to the westward. This is a slow current, but when it joins the Gulf Stream proper off the southern coast of the United States it materially adds to the latter on its way to the northern seas." From Cape Canaveral to Cape

Hatteras the Gulf Stream maintains its high temperature and specific gravity; if the observations can be relied upon, we have in the vicinity of Cape Hatteras and Cape Fear gravities of above 1·028. It is certainly surprising that within 40 miles of Cape Hatteras and so far away from the regions where according to the best published charts we would naturally look for a maximum of specific gravity, we should find waters of such density as is nowhere else met with in the open ocean, and which only finds its equal in the Red Sea and the eastern part of the Mediterranean. But how does it happen that the Gulf Stream near Cape Hatteras, at such a great distance from its source, at the comparatively high latitude of 35°, and in the close vicinity of the cold current, which sometimes is called "the Labrador" and again "the cold wall," should have a temperature and density exceeding that of the adjoining ocean? We have seen that the stock of salt and heat, with which the Gulf Stream started on its journey, almost gave out before reaching Florida Cape, and that upon entering the open ocean the Gulf Stream draws its supply from the waters it meets. Now, as surely as a stream can not rise above its source, the Gulf Stream could not be warmer and salter than the ocean if it had not an independent source of supply. According to the explanation which we have advanced above, this source of supply is in the lower depths of the Gulf Stream, and the acquisition is made by vertical instead of horizontal circulation.

This might be the proper place to make some inquiry about the effect of the distribution of salt and heat as we find it in the Gulf Stream upon its level, and about the effect of difference of level upon the Gulf Stream current. These, however, are matters which require careful study and more careful and comprehensive observations than are at present available. For the purposes of the subject in hand it was quite sufficient to accept the existence of the Gulf Stream current, as it is revealed by examination, as a physical fact, and to confine ourselves to a study of its relation to the temperatures and specific gravities of the waters of the Atlantic.


E
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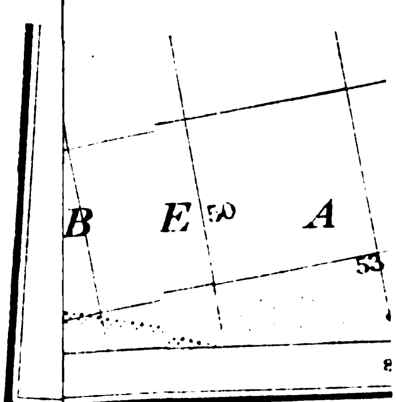
B
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APPENDIX No. 7—1895.

GRAPHIC METHOD OF REDUCING STARS FROM MEAN TO APPARENT PLACES.

By E. D. PRESTON, Assistant.

The reduction of stars from their mean places at the beginning of the year, as given in the catalogue, to their apparent places at any given time, as found by observation, forms a very considerable part of the astronomical calculations made in the Coast and Geodetic Survey Office. This work is especially heavy in our latitude computations, and the labor has been accentuated in recent years by the attention given to the subject of latitude variation.

There are several ways of abridging the numerical calculations, depending on the relation between the number of stars observed and the number of nights on which observations are made. For example, if many stars are observed on two or three consecutive nights, differential formulæ may be applied by means of which, the position having been obtained on any one date, that on succeeding dates may be found in about one-third the time required to get the first one. This method is given in Appendix No. 13, Coast and Geodetic Survey Report for 1888. When, however, observations are continued for a long time on the same stars, a condition that necessarily follows in researches on the variations of latitude, the reductions can be very much facilitated by a method employed in Appendix No. 2, Report for 1892. This method, which consists in applying Bessel's numbers by differences, enables the computer to obtain succeeding dates in about one-fourth the time required by the usual way. There are many cases, however, that do not fall strictly within the foregoing categories, and to meet these the present graphical method has been devised. Its advantages are rapidity and ease of application. No numerical work being necessary, the fatigue attending such operations is entirely avoided. The accuracy of the method can be increased to any desirable extent by enlarging the scale. That adopted in the following description will, however, meet all the requirements of our present instruments and methods of observation. This method was originally devised to shorten the work in the latitude computations, and has, therefore, been used only for declinations, but following the same principles, its application to right ascensions is also easily made.

GENERAL DESCRIPTION.

Three general diagrams are given. The first shows the lines necessary for all the stars and is the regular working sheet. The second and third are intended to show the construction for star No. 1381. (Catalogue of Stars for Observations of Latitude. Appendix No. 7, Report for 1876.)

In Pl. I we have a graphic representation of the day numbers A, B, C, D. The dimensions given refer only to the scale used in actual work and not to the printed sheets, which have necessarily been reduced for convenience of publication.

On a quadrant drawn with a radius of 20 inches, Pl. I, spaces are laid off equal to half degrees, corresponding to two minutes of right ascension. This scale enables one to indicate declinations to the nearest tenth of a degree and right ascensions to the nearest half minute with the greatest facility. With the exercise of a little care, on a slightly increased scale, the error in platting the former need not be more than a minute or two of arc, and the latter may be platted with a corresponding accuracy in time. Roughly speaking, the uncertainty of laying down the two

functions may be stated as about six seconds for the right ascensions and one and one-half minutes for the declinations. With the above-stated dimensions the trigonometrical functions may be read off to three places, and the multiplication, by the graphical method, of these functions by the day numbers can be accomplished so that the greatest error will be only a few hundredths of a second of arc, which is abundantly sufficient for the reduction of star places for the ordinary latitude observations with the zenith telescope.

Concentric with the quadrant having a radius of 20 inches another is drawn with a radius of 20·05 inches. This is for the purpose of finding 20·05 cos α. On the two radii bounding the quadrants are laid off spaces of tenths of an inch. The entire radius is, therefore, divided into 200 parts, which enables us to read to the two thousandth part of it. Through these points of division lines are drawn parallel to the radii, the result being that the entire surface is divided into small squares.

The divisions of the quadrant are numbered for declination in the center, and for right ascension on either side. The degrees of declination are not indicated again on Pls. II and III, as these are only intended to illustrate the method by application to a special case. The trigonometrical functions for the declination are used, however, on these sheets as they would appear on Pl. I.

The hours for the last argument are so chosen that the lines representing the star numbers a, b, c, d will fall horizontally. This facilitates their multiplication with the day numbers A, B, C, D, which are all platted vertically. On the margin is indicated the space in which the right ascensions must be sought for the different star numbers a, b, c, d. A negative sign before the hours indicates that the trigonometrical function is to be taken in this sense.

The quantities A, B, C, D are platted on the largest scale possible with the accompanying quadrant. This necessitates a slight change in the values of A, and they are laid down on a scale ten times their real value. For example, the value on June 9 is 0·507 and is platted as 5·07.

B may range from $+9''$ to $-9''$, so the marginal numbers are used and the correct value of this quantity multiplied by any of the trigonometrical functions will be given by reading the result from the scale at the left.

C and D range from about $+20''$ to $-20''$. They are platted so that the radial value would be 20. Since they are both symmetrical with reference to the horizontal line passing through the center, all values are platted above the horizontal radius and negative values, in all day numbers, are made apparent by using a right line in which dots are made for each individual day.

The scale of dates is laid off in the middle of the sheet and the value of the day numbers at a specified time may be found at the intersection of the corresponding curve, with the vertical line through the given date. By means of the horizontal lines the values of A, B, C, D may be transferred visually to the margin.

For example, on June 9 we have the values

$$A = +5{\cdot}07 \qquad B = -8{\cdot}35 \qquad C = -3{\cdot}57 \qquad D = -20{\cdot}07$$

Referring now to Pl. II, we shall show the construction of the quantities

$$\begin{aligned} a'\,A &= 20{\cdot}05 \cos \alpha \times A \\ b'\,B &= -\sin \alpha \times B \\ c'\,C &= (\tan \omega \cos \delta - \sin \alpha \sin \delta) \times C \\ d'\,D &= \cos \alpha \sin \delta \times D \end{aligned}$$

It should be borne in mind, however, that in actual practice the method is very much shorter than would appear from the lines drawn in Pl. II.

For example, in finding the value of $a'\,A$ when we have once located the position of the right ascension $16^{h}\ 33^{m}{\cdot}5$ on the quadrant, it is seen by mere inspection that the quantity 20·05 cos α is equal to $-7{\cdot}38$. In fact, it is not necessary to know the numerical value of this quantity, since it is to be multiplied by A, and it is only the final product that we care to determine. A fine thread being attached at the center O and the other end being held by the hand at J, the intersection of this thread with the vertical line through the point of right ascension (G) gives at once the value

of $a' A$ or $-3·74$. No lines are actually drawn, but the final products are found by projecting selected points, with the eye, either horizontally or vertically until they meet the line of the thread. This visual projection is rendered easy and accurate by the small spaces into which the sheet is divided.

Moreover, on the regular working sheet both the quadrants indicating right ascensions and declinations and the curves for the day numbers are drawn. The diagrams are separated for illustration and to avoid confusion in the construction lines which, in the regular work, are never drawn. For the sake of comparison, the logarithmic computation employing Bessel's numbers is here given for the apparent declination of star No. 1381.

STAR No. 1381.

Catalogue of stars for observations of latitude, Appendix No. 7, Report for 1876.

REDUCTION FROM MEAN TO APPARENT DECLINATION.

		Log.	No.
$\alpha = 16^h\ 33^m\ 41^s = 248°\ 25'$	$\sin\alpha$	$= 9·9684_n$	$-0·930$
$\delta = 53°\ 7'$	$\cos\alpha$	$= 9·5657_n$	$-0·368$
	$\sin\delta$	$= 9·9030$	$+0·800$
	$\cos\delta$	$= 9·7783$	$+0·600$

To find $a'\ b'\ c'\ d'$

Terms.	a' $20·05_2 \cos\alpha$	b' $-\sin\alpha$	c' $\tan\omega\cos\delta - \sin\alpha\sin\delta$		d' $\cos\alpha\sin\delta$
Computation.	*Logs.* 1·3022 $9·5657_n$	*Logs.*	*Logs.* 9·6373 9·7783 9·4156 +0·2604	*Logs.* $9·9684_n$ 9·9030 $9·8714_n$ 0·7437	*Logs.* $9·5657_n$ 9·9030
			+1·004		
Logs. $a'\ b'\ c'\ d'$	$0·8679_n$	9·9684	0·0017		$9·4687_n$
" $A\ B\ C\ D$	9·7055	$0·9215_n$	$0·5521_n$		$1·3026_n$
	$0·5733_n$	$0·8899_n$	$0·5538_n$		0·7713
Nos. $a'A\ b'B\ c'C\ d'D$	−3·74	−7·76	−3·58		+ 5·91
For June 9:					
Nos. $a'\ b'\ c'\ d'$	−7·38	+0·930	+1·004		− 0·294
" $A\ B\ C\ D$	+0·508	−8·35	−3·57		−20·07

GRAPHIC DETERMINATIONS.

REDUCTIONS IN DECLINATION.

Proceeding now to determine the quantities $a'A\ b'B\ c'C\ d'D$ for star No. 1381, we shall indicate data and final results by full lines; construction lines are dotted; partial results which are intermediate between the data and the results, such as the values of $\tan\omega\cos\delta$, $\sin\alpha\sin\delta$, etc., are shown in broken lines. The reduction is made from the mean place on January 0, 1895, to its apparent place on June 9, 1895.

The position of the star is (taking the nearest half minute in α)

$$\text{Right ascension} = \alpha = 16^h\ 33^m·5$$
$$\text{Declination} = \delta = 53°\ 7'$$

FIRST TERM.

To get $a'A = 20''·05 \cos\alpha \times A$. (See Pl. II.)

We seek the value of α in the quadrant marked (a and d) and read at once the value of 20·05 $\cos\alpha$ or FG on the outer one of the arcs. The negative sign before 16 indicates that the cosine of the right ascension is minus. This quantity, which is $-7·38$, is to be multiplied by the value of A on June 9. On this date we see by inspection from Pl. I that A equals $+0·507 \times 10$ or the line

HI. In order to multiply the two lines *FG* and *HI*, *I* is projected to *J*. The point *J* is the intersection of a horizontal line through *I* and a vertical line at a distance of 10 units from the origin *O*. The point of intersection of the vertical through *G* and the line *JO* determines the length of the line *KL*, which is equal to *FG* multiplied by *HI* or 20·05 cos $\alpha \times A$, therefore,

$a'A = -3{\cdot}74$ (agreeing with the logarithmic computation previously given).

This follows from the proportion

$$hJ : hO :: LK : LO$$
$$\text{or } HI : 10 :: LK : FG$$
$$\text{Hence } LK = \frac{HI \times FG}{10}$$

which gives *LK* in correct units, since the value of *A* or 0·507 was platted on a scale ten times its true value.

When a number of stars are to be reduced for the same date the point *J* applies to all, and the values of $a'A$ for the separate stars are the vertical lines included between the axis of abscissas and the line *JO*. The lines are, of course, vertically under the points on the arc corresponding to the stars' right ascension.

For the sake of uniformity in the process of multiplication, the day numbers *A*, *B*, *C*, *D* are always projected to the vertical scale at the right when finding the products $a'A$, $b'B$, $c'C$, $d'D$. It is evident that the same result would ensue by projecting the star numbers a' b' c' d' to the horizontal scale at the top, drawing the radial line and measuring the intercept obtained by projecting the day numbers to the left. For example, if *G* is projected to m'' and $m''O$ is drawn, it will intersect the line *JI* prolonged in K'', giving $L''K'' = -3{\cdot}74$ as before. The algebraic proportions may be written out similarly to those above. If *G* is projected to m' and the line $m'O$ is drawn, it will intersect the line $J'I'$ prolonged, in K' giving $L'K' = -3{\cdot}74$ as before. In the figure the lines Gm' and $m'O$ are not drawn to avoid confusion with lines already drawn. Without writing out the proportions it is quite evident that in the triangle $L'K'O$ the line $L'K'$ is $\frac{7{\cdot}38}{20}$ of $L'O$, so that it is equal to $\frac{7{\cdot}38}{20}$ of $(2 \times 5{\cdot}05)$. Likewise in the triangle $L''K''O$ the line $L''K''$ is $\frac{7{\cdot}38}{10}$ of $L''O$ and is therefore $\frac{7{\cdot}38}{10}$ of 5·05, both of these being equivalent to the first construction, viz, $7{\cdot}38 \times 0{\cdot}505$.

To avoid extrapolation, in cases where the value of 20·05 cos α is represented by a line longer than ten units *A*, may be platted on a scale twice as large as that just used, which would make the point *I* fall at I'. I′ is then to be projected to J' and the value of $a'A$ is as before $-3{\cdot}74$. If *A* is platted on this scale nearly every value of 20·05 cos α will be shorter than the horizontal distance between *O* and the point to which I' is projected, or J', and the values of $a'A$ will be vertical lines lying between J' and the center, so that the only extrapolation resorted to is that for values of a' between 20·00 and 20·05. But no sensible error would be introduced by following the first construction.

The scale at the left or right gives the result in correct units. This follows from the proportion

$$H'J' : H'O :: LK : LO$$
$$\text{or } HI' : H'O :: LK : FG \text{ as previously given.}$$

$$\text{Hence} \qquad LK = \frac{\mathrm{HI'} \times \mathrm{FG}}{\mathrm{H'O}} = \frac{(0{\cdot}505 \times 20)}{20} \quad (-7{\cdot}38) = -0{\cdot}505 \times 7{\cdot}38$$

SECOND TERM.

To get $b'B = -\sin \alpha \times B$. (See Pl. II.)

We now use the inner quadrant or the one described with a radius of 20.

Find the right ascension in the quadrant marked (*b* and *c*). The sine for radius 20 is equal to *MN* or $-0{\cdot}930 \times 20$. The value of *B*, on June 9 is *HP* or $-8{\cdot}35$. Project *P* to *Q*. The intersection of the vertical line through *N* with the line *OQ* gives the point *R* and the distance *RS* read from the scale gives 7·76, which is the value of sin $\alpha \times B$.

In actual work the thread being held at Q and the point N being selected by inspection, the position of R and its value on the scale are read off instantly without either drawing lines or writing figures. This advantage, of course, applies to all determinations by this method.

We have the proportion

$$H'Q : H'O :: SR : SO$$
$$\text{or} \quad HP : H'O :: SR : MN$$

Hence $$SR = \frac{\mathrm{HP} \times \mathrm{MN}}{\mathrm{H'O}} = \frac{(-8{\cdot}35)\ (-0{\cdot}930 \times 20)}{20} = +7{\cdot}76$$

The value of $b'B$ is then $-7{\cdot}76$.

As in the case of $a'A$ all reductions for stars on June 9 have one point in common (here Q) and the values of $\sin \alpha \times B$ will appear as vertical lines included between the line QO and the axis of X.

In giving the values of the trigonometrical functions, the factor 20 is always written, as that is the number of units in the radius. The natural value of the function is, of course, the first factor.

THIRD TERM.

To find

$$c'C = (\tan \omega \cos \delta - \sin \alpha \sin \delta) \times C$$
$$\omega = 23^\circ\ 27' = \text{obliquity of ecliptic}$$
$$\tan \omega = 0{\cdot}434$$

We first find the second term of the parenthesis. By the same construction as was used for $b'B$ the sine of α is $-0{\cdot}930 \times 20 = MN$. The sine of δ is TV or $+0{\cdot}800 \times 20$. These quantities must be multiplied in such a way that the product is a horizontal line, viz, by projecting N to U and noting the point where the line UO intersects the horizontal line through V. The line XY is equal to $-14{\cdot}88$ or $-0{\cdot}744 \times 20$. We therefore have for the second term of the parenthesis on the actual scale

$$\sin \alpha \sin \delta = -0{\cdot}744 \times 20 = -14{\cdot}88$$

This follows from the proportion

$$qU : qO :: XY : XO$$
$$\text{or} \quad MN : qO :: XY : TV$$

Hence $$XY = \frac{MN \times TV}{qO} = \frac{\sin \alpha \sin \delta}{qO} = \frac{(-0{\cdot}930 \times 20)\ (0{\cdot}800 \times 20)}{20}$$
$$= -0{\cdot}744 \times 20 = -14{\cdot}88$$

We now find the first term of $c' = \tan \omega \cos \delta$.

The cosine of δ is XV or $+0{\cdot}600 \times 20 = 12{\cdot}00$.

Project V to W. Draw OW. Where this intersects the horizontal line through Z determines the distance ZE which is

$$\tan \omega \cos \delta \text{ or } +0{\cdot}260 \times 20 = +5{\cdot}20$$

the sum of the two terms of c' is therefore $(5{\cdot}20 + 14{\cdot}88)$ or $1{\cdot}004 \times 20 = 20{\cdot}08$. The distance ZO is twenty times the natural tangent of the obliquity of the ecliptic and the line through Z is drawn once for all, as it is common to all the stars. In order to have the two terms of c' on the same scale, Z is taken at a distance from the axis of X of $20 \times 0{\cdot}434 = 8{\cdot}68$, so that we have the proportion

$$qW : qO :: ZE : ZO$$
$$\text{or} \quad XV : qO :: ZE : \tan \omega \times 20$$

Hence $$ZE = \frac{XV \times \tan \omega \times 20}{qO} = \frac{(0{\cdot}600 \times 20)}{20} (\tan \omega \times 20)$$
$$= 0{\cdot}600 \times 0{\cdot}434 \times 20 = 0{\cdot}260 \times 20$$

The value of ZE is laid off on the prolongation of XY, giving the point A where

$$XA = XY + YA = (0{\cdot}260 + 0{\cdot}744) \times 20 = +1{\cdot}004 \times 20$$

the first term of the value $c'C$ being positive and the second term negative, their difference is $+20{\cdot}08$.

This is to be multiplied by the value of C on June 9, which is $-3{\cdot}57$. Project B to C. Draw CO. Where the vertical line through A meets CO prolonged gives the point D and the line DD' is the product $c'C$ or

$$(\tan \omega \cos \delta - \sin \alpha \sin \delta) \times C \text{ or } -3{\cdot}59$$

we have

$$H'C : H'O :: D'D : D'O$$
$$\text{or } HB : H'O :: D'D : XA$$

Hence

$$D'D = \frac{HB \times XA}{H'O} = -\frac{3{\cdot}57\ (1{\cdot}004 \times 20)}{20} = -3{\cdot}58$$

If $\sin \alpha \sin \delta$ is positive, the value of ZE is laid off to the left of Y, the construction being otherwise the same.

FOURTH TERM.

To find

$$d'D = \cos \alpha \sin \delta \times D$$

Seeking the right ascension in the quadrant marked (a and d) we find $\cos \alpha$ for radius 20 to be fg or $-0{\cdot}368 \times 20$. This must not be confounded with $-0{\cdot}369 \times 20$, which is on the same scale the value of $20{\cdot}05 \cos \alpha$, and which is measured on the outer circle. The sine of δ is TV, or $0{\cdot}800 \times 20$. Project g to m. Where the line mO intersects the line XV, already drawn, determines the point n. Xn is then the value of $\cos \alpha \sin \delta$, or

$$-0{\cdot}294 \times 20 = -5{\cdot}88$$

We have

$$qm : qO :: Xn : XO$$
$$\text{or } fg : qO :: Xn : TV$$

Hence

$$Xn = \frac{fg \times TV}{qO} = \frac{(-0{\cdot}368 \times 20)\ (+0{\cdot}800 \times 20)}{20} = -0{\cdot}368 \times 16{\cdot}00 = -5{\cdot}88$$

The line Xn is now to be multiplied by $-20{\cdot}07$, the value of D, on June 9, which we find equal to the line Hp. Project p to a. Draw aO. The intersection of aO with a vertical line through n gives the point t and we have rt equal to $\cos \alpha \sin \delta \times D$, or to $+5{\cdot}90$.

We have

$$H'a : H'O :: rt : rO$$
$$\text{or } Hp : H'O :: rt : Xn$$

Hence

$$rt = \frac{Hp \times Xn}{H'O} = \frac{(-20{\cdot}07\ (-0{\cdot}294 \times 20)}{20} = +5{\cdot}90 = d'D$$

$$= \cos \alpha \sin \delta \times D$$

The slight discrepancies between the results of the logarithmic computation and those of the graphic method may either come from the uncertainties in reading the scale in the latter case or from excessive use of decimals in the former. For example, the logarithm of D in the computation is $1{\cdot}3026$. These are the figures given in the ephemeris, and to 4 places they correspond to the number $20{\cdot}07$. But in the actual work they have the effect of a quantity slightly greater, and the combination of several logarithms under these conditions may give a result differing entirely in the last place from that obtained by the use of the natural numbers to a corresponding degree of accuracy.

REDUCTIONS IN RIGHT ASCENSION.

(Pl. III.)

In the reductions for right ascension the curves for the day numbers A, B, C, D are used as already plotted, and the star numbers are so constructed that the lines representing a, b, c, d fall horizontally.

This may be readily effected since they all depend on at least three quantities, and these may be multiplied in such a way as to give the resulting line either desired direction.

The inner quadrant, already drawn, holds good for the right ascensions as already used for declinations. In seeking the trigonometrical functions of δ, however, the degrees count in the opposite direction; to facilitate this each degree has its complement written opposite.

In finding the values of a and b it is necessary to use the value of tan δ. This is obtained, where the declination is less than 45°, from the horizontal line at a distance of 10 units from the origin. A line drawn from the given degree to the point O intersects it at a vertical distance from the origin equal to ten times the natural tangent of the angle. This construction gives us three units in the value. We may now proceed to the final result by using this value, or two units may be employed and the construction carried forward on the scale used for arcs beyond 45°. Both these methods will be indicated later.

In order to compare results the usual logarithmic computation is now given.

STAR NO. 1381.

Catalogue of stars for observations of latitude, Appendix No. 7, Report for 1876.

REDUCTION FROM MEAN TO APPARENT RIGHT ASCENSION.

		Log.	No.
$\alpha = 16^h\ 33^m\ 41^s = 248°\ 25'$	$\sin\alpha$	$=9·9684_n$	$=-0·930$
$\delta = 53°\ 7'$	$\cos\alpha$	$=9·5657_n$	$=-0·368$
	$\tan\delta$	$=0·1247$	$=+1·33$
	$\sec\delta$	$=0·2217$	$=+1·67$

Terms.	a $3^s·073 + 1·337 \times \sin\alpha \tan\delta$	b $\frac{1}{15}\cos\alpha\tan\delta$	c $\frac{1}{15}\cos\alpha\sec\delta$	d $\frac{1}{15}\sin\alpha\sec\delta$
Log. 1·337.	0·1261			
" sin α.	$9·9684_n$			
" tan δ.	0·1247			
Sum logs.	$0·2192_n$			
No.	−1·656			
No.	3·073	8·8239	8·8239	8·8239
Sum.	1·417	$9·5657_n$	$9·5657_n$	$9·9684_n$
		0·1247	0·2217	0·2217
Logs. $a\ b\ c\ d$	0·1514	$8·5143_n$	$8·6113_n$	$9·0140_n$
" $A\ B\ C\ D$	9·7055	$0·9215_n$	$0·5521_n$	$1·3026_n$
" $aA\ bB\ cC\ dD$	9·8569	$9·4358_n$	9·1634	0·3166
Nos. " " " "	+0·719	+0·273	+0·146	+ 2·073
" $A\ B\ C\ D$	+0·507	−8·35	−3·57	− 20·07

CONSTRUCTION OF AUXILIARY LINES.

In order to find the tangents from 0° to 45° the line jp is used. These values may be reduced either graphically or mentally. For values of the declination between 45° and 87°, the tangents are read from the lines $t\ t'\ t''\ t'''$ and t^{v}, of Pl. I. The method of construction enables us to find the values for every minute of arc. The curve t applies to declinations from 45° to 50°; t' extends from 50° to 60°, etc. The units in the degrees are given by the vertical scale, and each small square represents vertically 6 minutes of arc. The tangents are the horizontal lines included between the axis of ordinates and the respective curve; e. g., the tangent of 68° is 2·48, the tangent of 85° is 11·43, etc.

The secants which are necessary in finding the values of c and d are obtained from the curves $S'\ S''\ S'''$, etc. In order to facilitate their multiplication by sin α and cos α the curves are drawn so that the secants are vertical lines and count from the axis of abscissas. From 45° on they are found in a similar manner to the tangents, but below 45° the curve S is used, which gives three places with sufficient accuracy. Referring to the case before cited, where the tangent of an angle less than 45° is to be employed, let us suppose where $\delta = 25°$. The tangent, by the construction already indicated, would be found (Pl. III) on the line jp at p' where $jp' = 0·466$.

If we only desire two places, instead of reading the value from the line jp, it may be read from the horizontal line at a distance of 1 unit from the axis of abscissas and we get 0·47. This being on the same scale as the tangents beyond 45°, the subsequent proceeding is in every way similar. Should three places be desirable, project p' to p''; then $p''\,p'''=10\times\sin\alpha\tan\delta=4{\cdot}33$ and the true value of $1{\cdot}337\sin\alpha\tan\delta$ required in the construction of aA will be found by projecting p'' to the axis of ordinates and thus determining the line $p^{iv}p^{v}=0{\cdot}58$, jk' being made $=jo\times1{\cdot}034$. The same result, by an analogous construction, follows by taking both $\tan\delta$ and the factor 1·337 in their true proportion. This is not shown in the figure to avoid a multiplicity of lines and letters. It may be added, however, that inasmuch as the trigonometrical function by which $\tan\delta$ is multiplied can never exceed unity, two places are sufficient for small values of δ and especially in view of the fact that in the quantity aA we have the factor A which is small, and in bB the quantity 15 appears in the denominator, both tending to reduce the number of necessary places.

FIRST TERM.

To find $aA=(3^{s}{\cdot}073+1^{s}{\cdot}337\sin\alpha\tan\delta)\times A$. (See Pl. III.)

The tangent of 53° 7′ is the line $cd=1{\cdot}33$. In order to verify this value, reference must be had to Pl. I; but in the regular work the determinations are made on the same sheet on which the curves are drawn. The sine of $16^{h}\,33^{m}{\cdot}5$ is $ab=-0{\cdot}930\times20$. Project b to f and draw fo. The vertical line gh at a distance from the axis of ordinates equal to cd and included between the line fo and the axis of abscissas is the product of $\sin\alpha\tan\delta$ or 1·24.

This follows from the proposition

$$ef : eo :: gh : go$$
$$\text{or } ab : eo :: gh : cd$$
$$\therefore \sin\alpha\tan\delta=gh=\frac{ab\times cd}{eo}=-\frac{0{\cdot}930\times20\times1{\cdot}33}{20}=-1{\cdot}24$$

Draw ko so that $jk=1{\cdot}337$ times jo. The horizontal line lm passing through the point h and included between the axis of ordinates and the line ko is therefore equal to the quantity $1{\cdot}337\sin\alpha\tan\delta$ or $-1{\cdot}66$. This follows from the fact that in the triangle jok each abscissa is 1·337 times the corresponding ordinate. The total value of the quantity within the parenthesis or a is therefore $3{\cdot}07-1{\cdot}66$ or $+1{\cdot}41$.

This quantity is to be multiplied by the value of A on June 9 or 0·507. The necessary lines for the multiplication of this quantity by any factor have already been drawn in the case of the declinations and in actual work their application to the right ascensions is directly made without new construction. The method is as follows:

The value of A projected to the line pn gives the point q and a vertical line rs included between qo and the axis of abscissas and at a distance from the origin equal to 1·41 gives the value of aA or $+0{\cdot}71$.

We therefore have

$$aA=(3^{s}{\cdot}073+1^{s}{\cdot}337\sin\alpha\tan\delta)\times A=+0^{s}{\cdot}71$$

SECOND TERM.

To find $bB=\frac{1}{15}\cos\alpha\tan\delta\times B$. (See Pl. III.)

The cosine of α is the line $uv=-0{\cdot}368\times20$.

The tangent of δ is $cd=og=1{\cdot}33$.

Project v to v' and draw $v'o$.

The intersection of this line with the vertical through d gives the point s'. We then have $gs'=\cos\alpha\tan\delta=-0{\cdot}49$.

Draw ox so that $jx=\frac{10}{15}\times jo$. The intersection of a horizontal line through s' with the line xo gives the point s'' and $s''y=\frac{10}{15}\cos\alpha\tan\delta=-0{\cdot}33$. The value of B on June 9 is $-8{\cdot}35$. This distance laid off on the line pn or, which is the same thing, the ordinate for June 9 being

projected to the vertical at a distance of 10 units from the origin gives the point Z. The intersection of a vertical line through s'' with the line Zo gives the point Z' and the distance

$$Z'Z'' = \frac{1}{15} \cos \alpha \tan \delta \times B = +0{\cdot}27$$

The object in laying off $jx = \frac{10}{15} jo$ is to secure one more decimal place in the value of b. The correct value in the final result is obtained in the multiplication by B since the construction gives us $\frac{835}{1\,000}$ of $\frac{10}{15} \cos \alpha \tan \delta$.

The line xo is used in the construction of cC and dD, as well as bB.

Introducing the factor $\frac{10}{15}$ serves the double purpose of giving one more decimal place, thus increasing the accuracy, and also of restoring the final result to the correct scale after multiplying by B.

THIRD TERM.

To find $$cC = \frac{1}{15} \cos \alpha \sec \delta \times C. \quad \text{(See Pl. III.)}$$

The secant of the declination is the line $AB = \sec 53^\circ\ 7' = +1{\cdot}67$. For verification see Pl. I. The intersection of a horizontal line through B with the line xo already drawn gives $A'B'$ which is

$$\frac{10}{15} \sec \delta = 1{\cdot}11$$

$$\cos \alpha = -0{\cdot}368 \text{ as before}$$

Project B' to B''

The intersection of a horizontal line through v with the line $B''o$ gives the distance $A'' = \frac{10}{15} \cos \alpha \sec \delta = -0{\cdot}408$.

The value of C on June 9 is $-3{\cdot}57$.

The intersection of a vertical line through the extremity of A'' with the line $V''o$ determines the line p, which is equal to $+0{\cdot}15$.

Hence $$P = \frac{1}{15} \cos \alpha \sec \delta \times C = +0{\cdot}15$$

As in the case of bB, the true value of the last result is given by multiplying finally by 0·357 instead of 3·57; this corrects for the artifice employed of magnifying the first partial result, viz, $\frac{1}{15} \sec \delta$ in order to secure one more decimal place. In the case of cC, since both $\cos \alpha$ and $\sec \delta$ are vertical lines, the latter is multiplied by $\frac{10}{15}$ in order to change its direction and thus facilitate its multiplication by $\cos \alpha$.

FOURTH TERM.

To find $$dD = \frac{1}{15} \sin \alpha \sec \delta \times D. \quad \text{(See Pl. II.)}$$

As in the previous case, we have $\frac{10}{15} \sec \delta = A'B' = 1{\cdot}11$ and by previous construction $\sin \alpha = a\,b = -0{\cdot}930 \times 20$.

The intersection of a horizontal line through b with the line $B''o$ gives the line MN, by which we have

$$M\,N = \frac{10}{15} \sin \alpha \sec \delta = -1{\cdot}03$$

The value of D on June 9 is $-20{\cdot}07$.

This value is projected to a vertical line at a distance of 10 units from the axis of ordinates, thus correcting for the factor 10 introduced in the value MN.

A vertical line through N intersects the line $N'o$ at a distance $M'p'=2{\cdot}07$ from the axis of abscissas and we have finally

$$M'p' = \frac{1}{15} \sin \alpha \sec \delta \times D = +2{\cdot}07$$

Attention may be called, in conclusion, to the striking manner in which the principal characteristics of the values A, B, C, D are brought out in the graphical representations. By reference to Pl. I it will be noticed that both A and B have two large maxima and minima during the year. In addition to this each curve is marked by a number of smaller maxima and minima. C and D, being dependent on the cosine and sine of the sun's longitude, present but one maximum and one minimum.

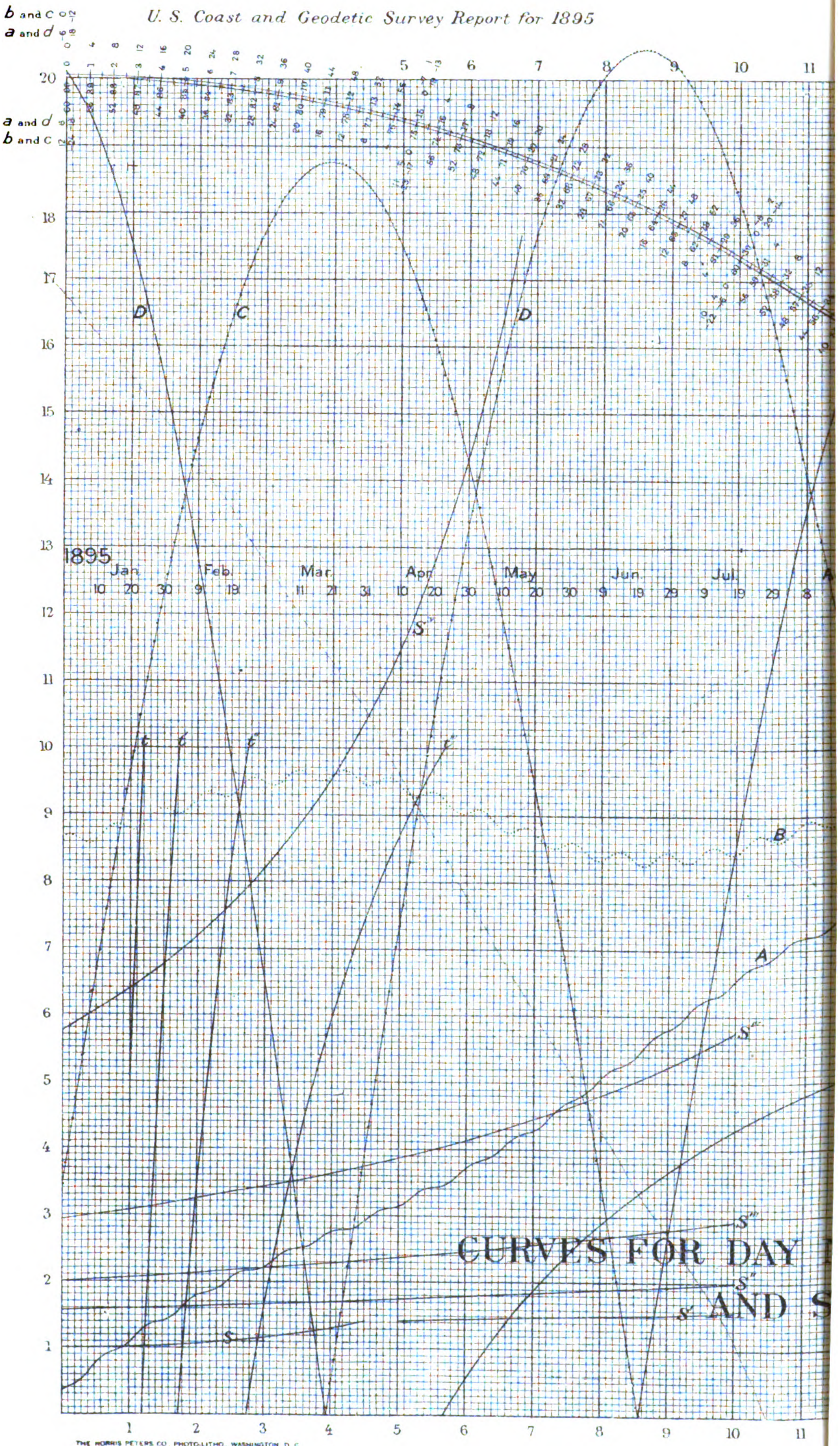
The general increase of A is the result of the term depending on the sine of the longitude of the moon's ascending node, combined with the value of t, which increases much more rapidly than the sine term decreases. The term depending on twice this function, being of the opposite sign, would tend to diminish this effect; but as it is only about 1 per cent of the first term its influence is barely perceptible.

The general decline of B, negatively, is caused by the cosine of the function mentioned, and is seen to be about three-fourths of one second as the formula requires. As, in the case of A, the function depending on the double angle modifies this to some extent.

The two major maxima and minima in both A and B are produced by the terms depending on twice the sun's true longitude, the double angle accounting for the four appearances of the extreme values. It will be noticed that the range in A is about $0{\cdot}05$ and in B about $1''$, as demanded by the formula. In this connection it should be remembered that A is platted on a scale ten times its true value.

The minor maxima and minima in A and B show the effect of the term depending on the moon's mean longitude.

The range for A is about one-half as much as that for B. There are 27 maxima and 27 minima during the year in each curve, which corresponds to twice the moon's motion.



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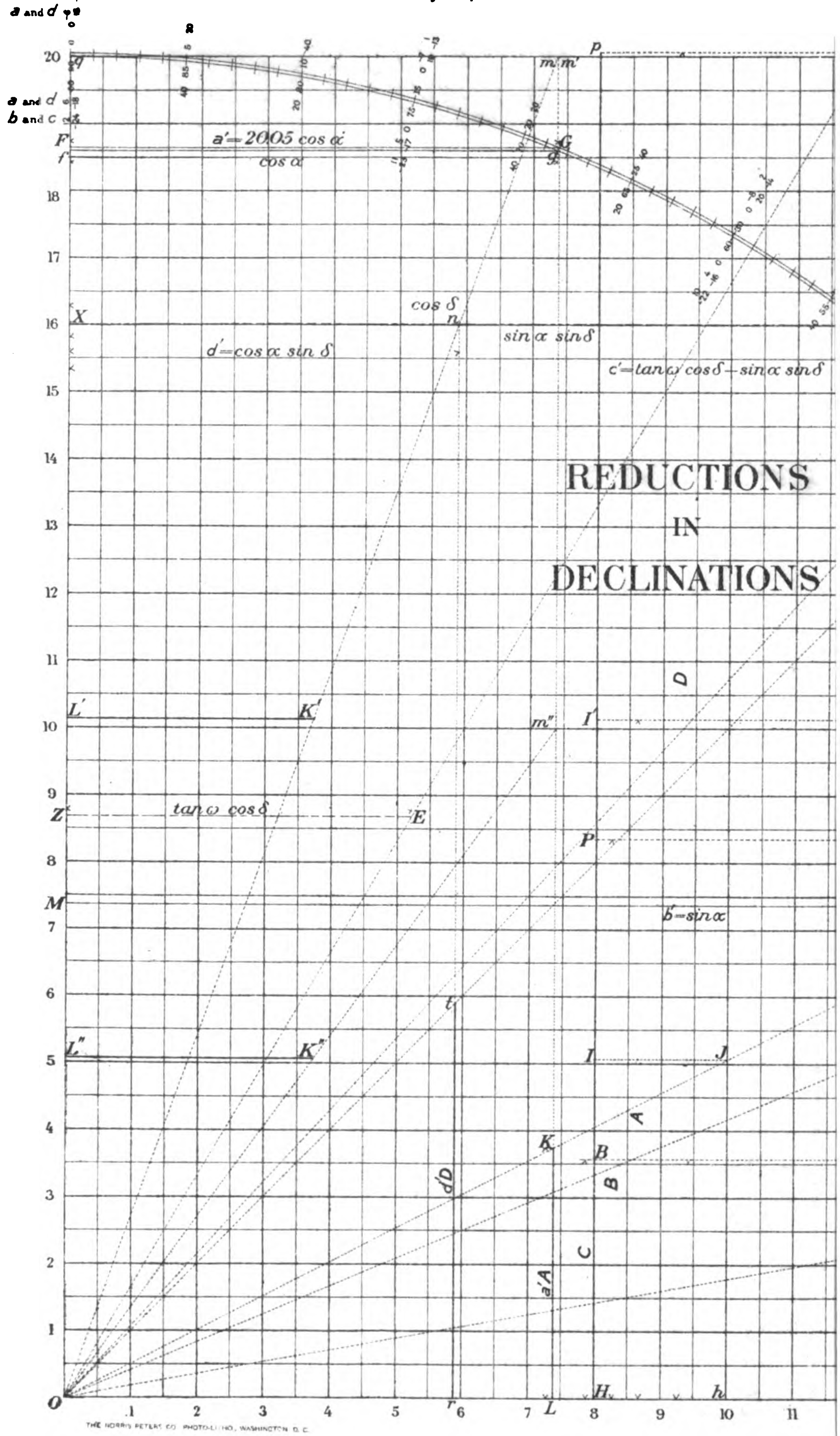
REDUCTIONS
IN
DECLINATIONS
b and c
a and d
a and d
b and c
a′=20.05 cos α
cos α
cos δ
sin α sin δ
d′=cos α sin δ
c′=tan ω cos δ−sin α sin δ
tan ω cos δ
b′=sin α
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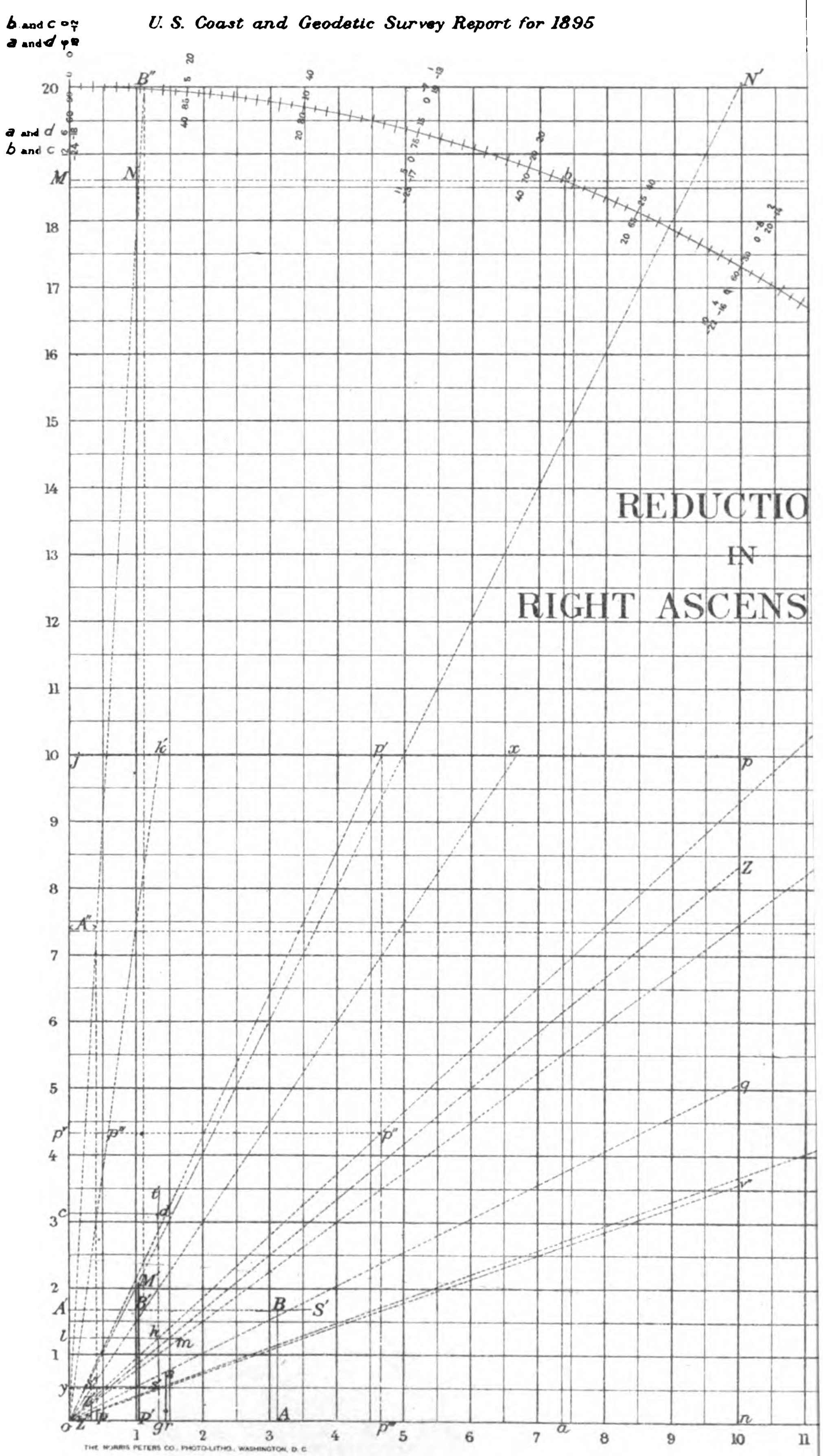

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APPENDIX No. 8—1895.

DESCRIPTION OF LEVELING RODS DESIGNED AND CONSTRUCTED FOR USE IN GEODETIC LEVELING OPERATIONS.

By ISAAC WINSTON, Assistant.

Leveling rods with the graduation on brass strips attached to wooden supports (see Appendix No. 15, Report for 1879, for description of rods as originally designed) have been in use by the Survey for many years. Modifications have been made from time to time with a view of improving the rods, but the rods have never been entirely satisfactory.

The difficulty of determining and applying the proper correction for the change in the length of the scale, due to changes of temperature while the rod is in use in the field, is very great, and has resulted in the attempt to avoid errors due to the source stated above by substituting a wooden rod (thoroughly saturated with paraffin) for the metal strip. The subject was referred to a committee appointed by the Superintendent, and the following is a description of the rod designed by the committee after considering all available data. The details of construction were worked out with great skill by the chief mechanician of the Survey.

White pine was chosen on account of the ease with which it can be impregnated with paraffin to prevent changes due to varying hygrometric conditions. A fine, permanent, and accurate graduation was secured by tracing it on the heads of metal plugs inserted in the rod at proper intervals. Use in the field has shown the rods to be in every way satisfactory.

They are described as follows:

The rod is made of well seasoned white pine wood, thoroughly saturated with paraffin, and is a little more than 3 metres long.

Each rod consists of a main strip of wood, 7 cm. wide and 2·1 cm. thick, along the center of each broad face of which is fastened by screws another strip of equal length and 2·5 cm. thick, thus forming a cross of symmetrical proportions. These strips were dressed very nearly to their proper size, the screw holes (eleven in number, 5 mm. in diameter and 300 mm. apart) were bored, and an additional hole (10 mm. in diameter) was bored in the main strip between each pair of screw holes and then the three pieces forming rod *Q* were immersed in melted paraffin, in a trough heated by a row of Bunsen burners, from 9.30 a. m. to 4 p. m., on February 5, 1895, when the lights were extinguished.

At 8 a. m., February 6, the burners were again lighted and kept so until 3 p. m. and then extinguished. On the next day the paraffin was warmed sufficiently to allow the removal of the rod.

	Kg.
Before paraffining the weight of the rod *Q* was	3·494
After immersion in fully heated paraffin for 12 hours the weight of the rod was	6·825
Paraffin absorbed by rod	3·331

a gain of about 95 per cent in weight.

The second rod, *P*, having been similarly treated, showed a gain of only 65 per cent. It was therefore immersed again.

	Kg.
Weight before paraffining	3·523
After immersion in fully heated paraffin for 15¼ hours it weighed	6·060
Paraffin absorbed	2·537

a gain of about 72 per cent in weight.

In these operations the temperature of the paraffin was uncertain, but it was high enough to cause smoking and to convert water into steam immediately. After the rods had been thus treated the pieces were dressed to their proper size and fastened together. They were then submitted to the Weights and Measures Office to have their coefficients of expansion determined. This determination was made by comparing their expansion during rising and falling temperatures, relatively, to the expansion of two tapes of the standard kind (Woodward's), the coefficients of which can be safely assumed. The coefficient deduced is 0·000 0042 per degree Centigrade.

A test of the hygroscopic properties of the rods was made by submerging one of them in a trough of water for nineteen hours, but no appreciable difference was developed. Holes were then bored in the face of the rod to receive the silver faced brass plugs, 5 mm. in diameter and 20 mm. long, which were inserted at intervals of 0·02 m. to receive the graduation. These plugs fit accurately in the holes made to receive them and are secured in position by a rivet passing through the wood and near the end of the plug. They project slightly above the face of the rod. A single line is cut across the silver end of each plug. The rods were again delivered to the Weights and Measures Office and the length of each 0·1 m. division determined. The fittings were then placed upon the rod.

The target, provided with guide pieces and friction springs, is moved up and down the face of the rod by means of an endless chain passing over a fixed pulley near the bottom of the rod and an adjustable one near the top.

A similar endless chain is attached to a lever and eccentric carried by the target, by means of which the latter can be clamped in any position on the rod without loss of time. An opening is made in the target to permit the graduation to be seen and it carries a millimetre scale 0·02 m. long, with a feather edge mounted on a spring which holds it slightly above the plugs and allows a reading to be easily made without parallax by pressing the scale against the plug while reading the rod. The zero of the graduation corresponds to the foot of the rod, and the zero of the scale to the center of the target. The rod is read directly to 0·001 m. and by estimation to 0·0001 m. A circular level is attached to the rod, by means of which it can be held in a vertical position, and a handle is screwed to its back for convenience in carrying it.

The face of the rod is divided by painting to 0·01 m., which serves the double purpose of a telemeter and of checking the reading of the rod by the rodmen and recorder. The decimetre divisions of the face of the rod are numbered on the face of one rib and marks to distinguish the metres are placed opposite these divisions on the other rib.

The bottom of the rod is made of metal and terminates in a rounded phosphor-bronze boss with a radius of 2·7 cm. It is so constructed that the point of support of the rod is in the same vertical plane as the graduation.

	Kg.
Weight of rod *P* finished	9·4
Weight of rod *Q* "	10·2

The foot plate is a circular disk of cast iron, about 15 cm. in diameter, with a depression (radius of 3·5 cm.) in the center for receiving the foot of the rod, and with prongs on the under side to secure immobility when properly pressed into the ground. These foot plates are similar to those already in use by the Survey.

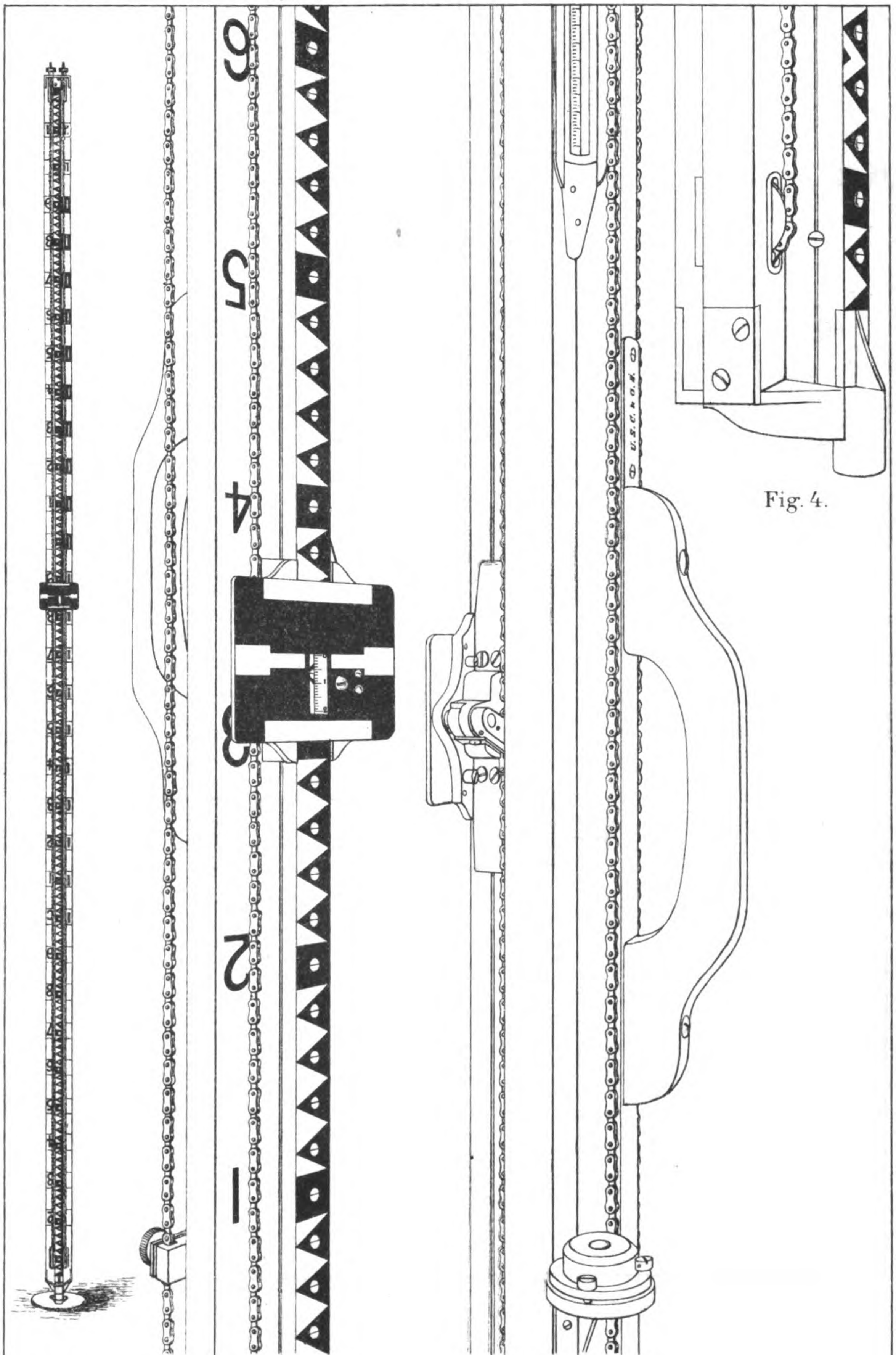

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

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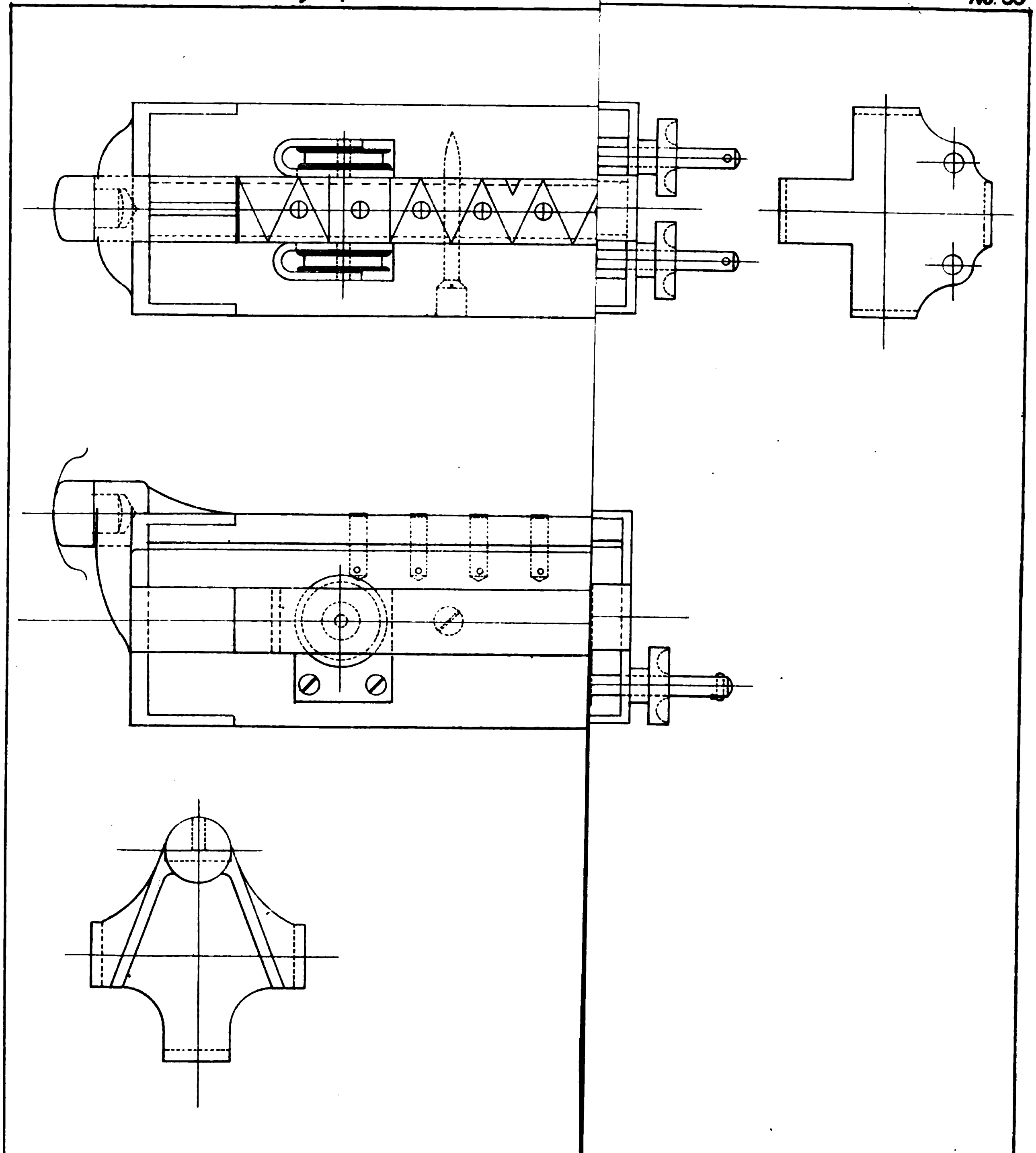

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APPENDIX No. 9—1895.

REPORT ON THE RUEPRECHT BALANCE BELONGING TO THE UNITED STATES OFFICE OF STANDARD WEIGHTS AND MEASURES.

Prepared by JOHN F. HAYFORD, Assistant, C. & G. S.

In September, 1890, the United States Office of Weights and Measures ordered a balance of precision from Alb. Rueprecht, of Vienna, balance manufacturer. It was stipulated in the order that the balance should be similar to one which had been made by the same maker for the International Bureau of Weights and Measures at Paris, and had been used for the intercomparison of the new national and international kilogrammes.

The balance forwarded upon this order was received in May, 1892. On its receipt it was inspected and put together, but because of the lack of a suitable place for mounting, it was not tested by actual use until January, 1895. This appendix exhibits the results of the tests then made.

The peculiar value of this balance as an instrument of precision arises partly from the high grade of workmanship upon it, but still more largely from two special auxiliary devices which enable the observer not only to note the motions of the beam from a distance, but also to interchange the weights upon the scale pans without approaching the balance. With a balance of precision of the ordinary type (at which the observer necessarily remains near the balance during the progress of the weighing), properly mounted in a room in which there are but slow changes of temperature, one of the principal sources of error is the nonuniformity of temperature in different parts of the balance case and balance resulting from the near presence of the observer. Hence the value of the auxiliary devices, which, by removing the observer to a distance, bring about a more uniform and constant temperature within the balance case, resulting in turn in a considerable increase of a precision which is already great by reason of the excellence of the balance proper.

The following description of the balance is, in the main, a free translation of the description of a similar balance, given in "Travaux et Mémoires du Bureau International des Poids et Mesures, Tome I, pp. D. 53–D. 58," and the accompanying plates are reproduced from that volume.

Pl. 40 is a perspective view of the balance after removing the protecting glass case. Pl. 41 is an elevation and plan of that part of the mechanism which is below the scale pans. Corresponding parts are lettered alike in these figures.

The beam is of brass, with steel knife edges. The distance from the middle knife edge to either end knife edge is about 180mm. The planes against which the principal knife edges act are of agate.

The arrestment apparatus, serving to separate the principal knife edges from their opposing planes for safety while the loads upon the pans are being changed, is actuated by the rod *a*, which slides within the central column. The lower end of the rod *a* rests upon one arm of the bell crank *Z*, which is moved by the screw *b*, controlled in turn by the shaft *c*,* which projects outside the balance case. The device at *e* serves as a stop to limit the travel of the screw *b*.

* The shafts shown at d_1, d_2, d_3, d_4 are not, in the balance belonging to the United States, extended through the balance case as indicated in the drawings.

The metal block (not clearly shown in the figures) which carries the agate plane, against which acts the end knife edge of the beam, also carries another agate plane which acts against another knife edge at right angles to the one just mentioned. These two knife edges and the block between them, which is restrained by proper guides, serve as a universal joint. From the knife edge which is parallel to the beam, a rod, jointed by knife edge and plane in two places to form a second universal joint, carries the weight of the scale pan. This pair of universal joints insures with considerable accuracy that the relative position of the beam knife edge and its opposing plane shall always be the same, and that the distribution of pressure along the beam knife edge shall always remain constant.

A special device insures that after the arrestment of the balance, and during transposition of weights, the scale pans shall always be held in exactly the same position. Two rods, f_1 and f_2, carry at their upper extremities a part of a circular ring h, on which are fixed three foot plates of tempered steel, g_1, g_2, and g_3, the upper surface of one of which is convex, of the second is a conical depression, and of the third is a V-shaped groove. Each scale pan carries on its lower side two points and a plane, which rests upon the foot plates when the ring is raised to its highest position. This movement of the ring h is made simultaneously on the right and left by the action of the screws k k, of which the nut is in each case the cross-piece l joining the rods f. These screws are controlled by the shafts and gears m_1, m_2, m_3, m_4, ending on the outside of the case at the shaft c_2. The mechanism shown at n stops the motion when the ring h has reached the proper height and has raised the scale pans slightly.

The beam carries at each end a pointer, which is read against a divided scale. This method of reading the balance is used only in adjusting, or during approximate weighings. For the final weighings the readings are taken from a distance by another method. The beam carries a small horizontal mirror o and a total reflection prism p is fixed to the stationary central column just above o. In front of the balance, about 3·9 metres distant, upon a solid support, is a telescope and horizontal scale (2mm. per division). This telescope being properly adjusted and pointed upon the prism, an image of the horizontal scale is seen, and its displacement indicates the motion of the beam, just as in an ordinary form of galvanometer the displacement of the scale indicates the motion of the needle. To detect changes in the relative position of the prism and the telescope, there is placed just above the prism a small fixed mirror q which gives a second image of the graduated scale, which is stationary as seen in the telescope, so long as the adjustments remain undisturbed.

The transposition apparatus operates as follows: Each scale pan is cut out as shown in the figures to allow certain motions of the cross s, which is carried by the rod t, which in turn is held by a horizontal arm fixed to the shaft v. Shaft v both turns and slides in the boxes w_1 and w_2. Suppose at a given movement that the beam is arrested, the scale pan, with a weight upon it, is supported by the footplates, and the cross s is beneath the pan r. When the mechanism is actuated the rod t rises vertically at first, sliding through the hole u_1, and the cross s rises through the scale pan and lifts the weight from the pan. When the lower end of the rod t escapes from the hole u_1 the whole system turns about the axis v until the lower end of the rod t strikes the stop block y_2. The rod t then descends through the hole u_2, lowering the cross s through the platform x, upon which the weight is left standing.

These three movements of the crosses s are produced simultaneously on both right and left sides of the balance by a single movement of the shaft c_3, which projects outside the balance case. The shaft c_3, through the series of shafts and gears z_1, z_2, z_3, drives the shaft A, which carries the screw threads BB, which engage the wheels CC. Upon the same axis as the wheels CC are the cams DD. The axis v carries a fixed ring E and a loose disk F. Whatever the position of the axis v with the cross s, it always presses by its own weihgt and that of the load being transported upon the disk F, which in turn presses near its edge upon the cam D. As shown in the figures, the cam is cut in two curves, one concentric and the other eccentric with respect to the axis. Suppose the cross s to be underneath the pan and in its lowest position. If the cam is now turned by turning the shaft c_3, the disk F is forced up, carrying with it the cross s, which can not turn about the axis v because the rod t is still in the hole u_1. When t escapes from the hole u_1 the disk F and with it the ring E are carried along by the friction of F upon D and E upon F and

the cross s turns around the axis v until the rod t strikes the stop y_2. During this part of the motion the cross neither rises nor falls, because it is then the concentric part of the cam which is in action. Finally, the motion of the shaft c_3 being continued in the same direction, the disk F, and with it E and the cross s, descends until s is at the lowest point it can occupy beneath the platform x. The mechanism indicated at G serves to limit the motion of this part of the transportation apparatus in this direction—and in the other also. It is plain that the motion of the cross on the left side of the balance is the same as that on the right, and that the reverse motion can be produced by turning the shaft c_3 in the opposite direction.

By the manipulation just described in detail the weights are transported from the scale pan to the platforms x. By turning the shaft c_4, which actuates the shafts and gears H_1, H_2, H_3, H_4, the platforms x are turned 180° about the central column of the balance and so exchange places. The crosses s may then again be manipulated so as to transport the weights from the platforms x to the scale pans. The weights will have thus exchanged places in the pans.

All the operations for a weighing by Gauss's method may be made by turning the shafts c_1, c_2, c_3, c_4, which project outside the protecting glass case. Rods about 3·6 metres long were attached to these shafts and their distant ends supported in a convenient position within reach of the observer at the reading telescope, thus enabling him to remain at that distance during the whole progress of a weighing.

The forms of the scale pans, platforms, and crosses are such that weights of various sizes and shapes may be used, provided always that they have sufficiently large plane bases. In case two weights of the same nominal value do not quite balance, they may be equalized by placing small auxiliary known weights on the top of the lighter one—these small weights partaking of its motions during the manipulations and virtually being a part of it for the time.

The parts of the balance shown at K, L, M, and N are for the manipulation of small rider weights. Such weights were not used in the tests here reported.

The balance was, in January, 1895, mounted on a brick pier in a room in the southern part of the Butler Building, the building which serves in part as the library and archives of the Coast and Geodetic Survey. This room has but one outside wall and that (eastern) wall is almost entirely below ground. The three other sides of the room are partition walls. On the south and west the rooms next to the balance room have no artificial heat, and the same is true of the room above. The next room to the northward is, however, artificially heated. During the observations no artificial heat was used in the balance room, no light of day was admitted from the outside, and the necessary artificial light was furnished by incandescent electric lamps, and was consequently accompanied by but little heat. Under these circumstances the temperature conditions in the room were quite favorable to accuracy, as shown by the record. To make the temperature within the balance case still more uniform and constant, it was covered with a complete sheathing of two thicknesses of heavy opaque manila wrapping paper, through which a small hole was cut in the line of sight of the reading telescope.

During the weighings the barometic pressure was determined by a mercurial barometer hanging near the reading telescope, the relative humidity was observed by a hair hygrometer kept within the balance case, and the temperature of the air within the balance case was determined by two large Tonnelot thermometers graduated to tenths of Centigrade degrees and read to hundredths.

The four kilogramme weights intercompared in January and February, 1895, may be designated by the symbols K_4, K_a, K_g, and K_m.

K_4 is one of the two national prototype kilogrammes belonging to the United States. Its composition is 90 per cent platinum and 10 per cent iridium. Its shape is that of a cylinder, with height equal to diameter and with slightly rounded edges. It serves as a standard from which the values of the other three are to be derived.

K_a is a platinum weight, usually known as the Arago kilogramme. It is similar in shape to K_4. It was originally standardized by Arago by comparison with the kilogramme of the archives; was acquired by this country in 1821; was redetermined at the British Standards Office in London in 1879–80, and at the International Bureau of Weights and Measures in Paris in 1884.

K_g is a brass weight electroplated with gold. It is one of a set of such weights from 1 000 gm. to 1gm., which are used as working standards in this office. Its form is that of a cylinder with sharp edges, with a slight hollow in its bottom, and having a knob handle at the top. The handle is continuous with the weight.

K_m is a gilded weight, said to be of brass, and to have been made by the Geneva Society. It now belongs to the Case School of Applied Science at Cleveland, Ohio. The main body of the weight is nearly cylindrical, being slightly smaller at the bottom than at the top. The edges are rounded and the bottom is slightly hollowed out. The top carries a knob handle.

The densities and volumes of these weights are roughly as follows at 0° C.:

Designation.	Density.	Volume in cubic centimetres.
K_4	21·54	46·4
K_a	20·90	47·9
K_g	8·40	119·1
K_m	8·35	119·8

When either of the denser weights was weighed against one of the two brass weights the reduction to vacuo was so great, about 90 mg., that it was difficult to observe the density of the air with sufficient accuracy to enable this reduction to be made with as much accuracy as the balance indicated the relation of the weights in air. This matter will be treated in detail later.

The following weighings were made to obtain the relative masses of the four weights:

K_4	was	weighed	against	K_a	4	times.
K_4	"	"	"	K_g	4	"
K_4	"	"	"	K_m	4	"
K_a	"	"	"	K_g	4	"
K_g	"	"	"	K_m	11	"
K_a	"	"	"	K_m	4	"

Two weights having been previously placed upon the pans, and such auxiliary weights as were necessary to make them nearly balance in air having been placed upon them, the balance was made to oscillate and three readings of the scale were taken; two of the right-hand limit of the oscillation and one of the left-hand limit. The weights were then transposed upon the pans, the weight upon the right pan being moved to the left pan, and vice versa, and three more readings were taken. This process of transposing after each swing was continued until four swings, and therefore twelve readings of the scale, had been secured. The barometer, hygrometer, and thermometers were then read as quickly as possible, and the whole constituted a "weighing," as that term is here used. Each weighing required from twenty to forty minutes. Before proceeding to the next weighing the small auxiliary weights were changed for others.

Each weighing gave rise to an equation such as the following:

$$K_4 - K_a - 2{\cdot}04n + 0{\cdot}086 \text{ mg.} = 0$$

in which the symbols K_4 and K_a indicate the masses of the weights in question, n is the value of one scale division expressed as a mass; the coefficient of n is derived from the scale readings in the usual manner, and the absolute term is the algebraic sum of the masses of the small auxiliary weights and of the reduction to vacuo. The reduction to vacuo consists of the difference of volume of the weights on the two pans multiplied by the weight per unit volume of the surrounding air. The density of the air was computed from the readings of barometer, thermometers, and hygrometer, by means of the tables given in Travaux et Mémoires du Bureau International des Poids et Mésures, Tome I, pp. A. 51–A. 57.

From the four or more such observation equations involving any particular pair of weights, the most probable values for the two unknowns, n and the difference of mass of the two kilogrammes, were determined by a least square adjustment. It was thus assumed that n, the scale value, remained constant only for the few hours during which any one series of weighings

was being made. Moreover, the small auxiliary weights were chosen in such a way that n had in the different equations both plus and minus coefficients, of which the sum was so nearly zero that the derived difference of mass of the two weights was nearly independent of n and was derived with sensibly the same accuracy as if n were an absolutely known quantity.

From these adjustments, aside from the various values of n, there was obtained:

$$\begin{aligned}
& \quad\quad\quad\quad\quad \text{Mg.} \quad\quad\; \text{Mg.} \\
K_a - K_4 &= -\,4{\cdot}6206 \pm 0{\cdot}0104 \\
K_g - K_4 &= +\,0{\cdot}5741 \pm 0{\cdot}0070 \\
K_m - K_4 &= +\,3{\cdot}4267 \pm 0{\cdot}0062 \\
K_g - K_a &= +\,5{\cdot}2133 \pm 0{\cdot}0050 \\
K_m - K_g &= +\,2{\cdot}7995 \pm 0{\cdot}0156 \\
K_m - K_a &= +\,8{\cdot}0324 \pm 0{\cdot}0194
\end{aligned}$$

The mean of these probable errors is $\pm$ 0·0106mg.

During the above adjustments the largest residual developed was 0.105mg. or about one ten-millionth of the mass on either scale pan.

For convenience in computation let it be assumed that:

$$\begin{aligned}
& \quad\quad\quad\quad \text{Mg.} \\
K_a - K_4 &= -\,4{\cdot}6200 + X_1 \\
K_g - K_4 &= +\,0{\cdot}5600 + X_2 \\
K_m - K_4 &= +\,3{\cdot}3900 + X_3
\end{aligned}$$

The equations for the general adjustment are then, preserving the same order, as above:

$$\begin{array}{lllr}
 & & & \text{Mg.} \\
+X_1 & & & +0{\cdot}0006 = 0 \\
 & +X_2 & & -0{\cdot}0141 = 0 \\
 & & +X_3 & -0{\cdot}0367 = 0 \\
+X_1 & -X_2 & & +0{\cdot}3333 = 0 \\
 & +X_2 & -X_3 & -0{\cdot}0305 = 0 \\
+X_1 & & -X_3 & +0{\cdot}0224 = 0
\end{array}$$

The normal equations being formed and solved in the usual way, the residuals from these equations become:

$$\begin{array}{r}
\text{Mg.} \\
-0{\cdot}0009 \\
+0{\cdot}0179 \\
-0{\cdot}0170 \\
-0{\cdot}0002 \\
-0{\cdot}0182 \\
+0{\cdot}0012
\end{array}$$

the largest of which is about 1–55 000 000 of the mass on either scale pan. The probable error of each equation, computed from these residuals, is $\pm$ 0·0118mg., in substantial agreement with the value + 0.0106mg. derived above.

There is also obtained:

$$\begin{aligned}
& \quad\quad\quad \text{Mg.} \\
X_1 &= -\,0{\cdot}0015 \pm 0.0084 \\
X_2 &= +\,0{\cdot}0320 \pm 0{\cdot}0084 \\
X_3 &= +\,0{\cdot}0197 \pm 0.0084
\end{aligned}$$

If each observation equation be given a relative weight, proportional to reciprocal of the square of the computed probable error of its absolute term, as shown above, the relative weights vary from 1 to 15·2; the residuals and computed probable errors are about the same as before, and

$$\begin{aligned}
& \quad\quad\quad \text{Mg.} \\
X_1 &= -\,0{\cdot}0061 \\
X_2 &= +\,0{\cdot}0251 \\
X_3 &= +\,0{\cdot}0300
\end{aligned}$$

The assignment of equal weight to the observation equations corresponds to the assumption that when four weighings are made between a given pair of masses there is some error common to all four weighings (and therefore not indicated by any disagreement of the four results) which is large as compared with the computed probable error of the result from the four weighings. On the other hand, the assignment of relative weights proportional to the reciprocals of the squares of the probable errors assumes that there is no constant error whatever which is common to the four weighings of the series. Experience with balances here and elsewhere indicates that the fact lies somewhere between these two assumptions, and hence the mean of the two derived values for each of the quantities X_1, X_2, X_3, will be adopted as the most probable value.

Hence there is obtained as final values:

$$\begin{aligned} & \quad\ \ \text{Mg.} \qquad\quad \text{Mg.} \\ X_1 &= -0{\cdot}0038 \pm 0{\cdot}0084 \\ X_2 &= +0{\cdot}0285 \pm 0{\cdot}0084 \\ X_3 &= +0{\cdot}0248 \pm 0{\cdot}0084 \end{aligned}$$

The mass of K_4, as determined at the International Bureau of Weights and Measures, is 1kg — 0·0050mg ± 0·0020mg.

Combining this with the above values there is obtained:

$$\begin{aligned} & \quad \text{Kg.} \quad \text{Mg.} \qquad\quad \text{Mg.} \\ K_a &= 1 - 4{\cdot}6988 \pm 0{\cdot}0086 \\ K_g &= 1 + 0{\cdot}5135 \pm 0{\cdot}0086 \\ K_m &= 1 + 3{\cdot}3398 \pm 0{\cdot}0086 \end{aligned}$$

This probable error of ± 0·0086mg., as developed from the observations, is less than one part in one hundred million.

It was found in adjusting the six series of weighings, giving them equal weight, that the probable error of the result from each series was ± 0·0118mg., as derived from this general adjustment. If there were just four weighings in each series, this would make the probable error of a single weighing 2 (±0·0118mg.) = ± 0·0236mg., remembering that the coefficients of n very nearly balance in every case. If the circumstance be considered that one of the six series, the first in order of time, contained eleven weighings instead of four, this value will be but slightly increased. In the following discussion then the probable error of a single weighing will be considered ± 0·0236mg.

It is pertinent to attempt to locate some of the separate sources of error of which the combined effect is to produce this resultant error. It is especially pertinent first to estimate the errors which arise from causes external to the balance proper.

In the first place it should be noted that in four of the six series of observations the difference of volume of the two weights placed upon the pans was over 70 cubic centimetres, and the consequent reduction to vacuo about 90 milligrammes. This leads to an inquiry as to the magnitude of the errors arising from defective measurements of barometric pressure, of air temperature, and of relative humidity.

From comparisons of barometers, made in connection with these observations, it would appear that the probable error of a single reading of the barometer is about ± 0·04mm. In view of the fact that the barometer was read at the end of each weighing, and that the required pressure for the middle of each weighing had to be determined by interpolating back over an interval of about eleven minutes, the probable error of a single determination of the mean pressure during a weighing should be increased to about ± 0·071mm.

This is perhaps a fair estimate of the accidental errors. It is quite difficult, however, to estimate the constant error which may exist, arising from an erroneous value for the constant instrumental correction to the barometer. This can not, however, be satisfactorily estimated without recourse to a normal barometer, and such an instrument is not now available.

The barometer upon which depends the reductions to vacuo in these weighings was compared during the progress of the observations with one of the large standard barometers at the United States Weather Bureau Office in Washington. The assigned correction to the Weather Bureau

standard depends in turn mainly upon the continued substantial agreement of several such standards, which were transported from Kew several years ago, and upon the correctness of the Kew standards.

The two Tonnelot thermometers which served to determine the temperature of the air within the balance case were hung in a horizontal position at about the same height as the weights, and one was placed with the bulb near the north end of the case, and the other with its bulb near the south end. The zeros of these thermometers were redetermined at the close of the observations. The northern bulb always registered a higher temperature than the southern bulb. The northern wall of the room was the only one on the opposite side of which there was artificial heat, but there were no openings whatever through it.

The differences between the temperatures indicated by the two thermometers, varied from $0^\circ.04$ to $0^\circ.15$ C., but always preserved the same sign, the mean difference being $0^\circ.09$ C. Judging from these differences the accidental errors in temperature may be estimated at $\pm 0^\circ.03$ C. This causes an error in the reduction to vacuo, in the case of a brass weight against a platinum weight, of about ± 0.0096 mg.

The mean difference of $0^\circ.09$ between the two thermometers suggests that there is possibly a constant difference of a few hundredths between the temperature indicated by the mean of the two thermometers and the actual temperature of the air around the weights. When it is considered, however, that the thermometer bulbs were much nearer the weights than to each other, that the weights were moved about frequently from pan to pan, and so tended to acquire a mean temperature, and that the changes of temperature in the balance case were very slow (an extreme range of only $5^\circ.03$ in twenty-eight days, and of only $0^\circ.54$ during the working hours of any one day), it seems safe to assign $0^\circ.09$ as the maximum limit of constant error in the assigned temperature of the air around the weights. This corresponds to a constant error of about 0·0288 mg. in the weighings.

The hair hygrometer was standardized at the beginning and end of the observations by direct comparison with a wet and dry bulb thermometer of the form which is used by whirling to secure good ventilation around the bulbs. From the residuals observed in standardizing the hair hygrometer, and from the observed change in its constants, it is estimated that the assigned values for the relative humidity are in error by ± 2 per cent. This corresponds to an error of ± 0.0084 mg. in each weighing.

Usually about 90 mg. in small weights had to be used to make the two kilogrammes balance in air. These small weights were changed at every weighing so as to avoid introducing their errors as constant errors. From the recorded values of the probable errors of these small weights it would seem that the probable error introduced into each weighing by the uncertainty in the values assigned to them is about ± 0.0040 mg.

The following probable errors have thus been assigned to causes external to the balance proper, in the case of a brass against a platinum kilogramme:

	Mg.
Arising from errors in the barometric pressure	± 0.0071
" " " " " temperature	± 0.0096
" " " " " relative humidity	± 0.0084
" " " " small auxiliary weights	± 0.0040

Combining, there is obtained from the probable error in a single weighing arising from these four causes, ± 0.0151 mg.

This leaves for the probable error in a single weighing arising from the balance proper, $(0.0236)^2-(0.0151)^2=\pm 0.0181$ mg.

The error of the mere reading of the scale can produce hardly any appreciable portion of this error since each weighing depends upon twelve readings of the scale; the error in any one reading probably does not exceed 0·2 division, and a whole division corresponds to only 0·04 to 0·05 mg. But there are two sources of error which certainly exist which seem sufficient to account for the above error, to wit, changes of the relative temperature of the two arms of the balance, and changes in the sensibility of the balance.

The method of using the balance during the weighings here treated does not assume that the

arms are of equal length, but it does assume that the difference of their lengths is a constant for the interval over which the weighing extends. So, if one arm be constantly warmer than the other by a given amount, no error is thereby introduced into the result. But suppose that between the time when the swing is made with the weights in the position A–right, B–left, and the time when the swing is made in the position B–right, A–left, the right arm increases in temperature relatively to the left arm by 0°·001 C. The right arm (brass) will be longer relatively to the left arm by 1–50 000 000 than it was, and the indication of the balance will differ by 1–50 000 000 of 1 kg.= 0·0200 mg. from what it should indicate according to the assumption used in the computation. Half this error, or 0·0100 mg., will affect the mean result from the two swings. So, when a series of four swings are made, as in the observations with which we are here concerned, there will be 0·0100 mg. error in the result for every 0°·001 C., by which the mean* difference of temperature of the two arms for position A–right B–left differs from the corresponding mean* difference for position B–right A–left. When it is noted that the air in the balance case during the weighings was usually changing in temperature at the rate of about 0°·002 C. per minute, and that a complete weighing of four swings required not less than fifteen minutes, it seems as if this cause might account for most of the errors shown to be due to the balance proper.

The observed variations in the zero point of the balance will serve as a criterion for judging of this class of errors. By the zero point is meant that point of the scale which is midway between two observed equilibrium points corresponding to the positions of the weights A–right B–left and B–right A–left. If certain of the earlier observations, during which the balance was continually being readjusted, be omitted, the extreme range in the position of the zero point is from 95·38 to 106·53 on the scale. This range of 11·15 divisions corresponds to about 0·5000 mg., or to a change of 0°·025 C. in the relative temperature of the two arms of the balance. That is to say, the relative temperature of the two arms, as indicated in this way, varied only within a range of 0°·025 C. during weighings extending over the period February 1 to 18.

Let the effect of changes of sensibility be now considered. It is assumed in the computation that the sensibility remains constant during the progress of the four complete weighings between any particular pair of weights—usually a period of about three hours, but sometimes extending over the interval from one afternoon to the next forenoon.

The scale value of the balance is proportional to the distance, which will be called d, from the middle knife-edge down to the center of gravity of the combined beam and its load, considering the weight of the pans and the loads upon them to be concentrated at the outer knife-edges. To fully appreciate the meaning of the assumption that the sensibility remains constant even for a few hours, one must take into consideration the smallness of the distance d. It may be computed in two ways from observation. The length of each arm of the beam is 180 mm., and its period of oscillation with a kilogramme on each pan is about 52 seconds. The beam acts as a pendulum. Its oscillation is evidently just as it would be if the total mass of the pans and their loads was concentrated at the end knife-edges. For not only are all the forces due to gravity and inertia in these parts transmitted unchanged to the knife-edges, but the motion (for the small amplitudes here used) of each and every part of the pan and load being the same as that of the knife-edge, the moments of inertia in question are the same as if the masses were actually at the knife-edges. Compare this actual pendulum with a hypothetical simple pendulum consisting of a mass equal to that of the two kilogramme weights plus the two pans and their suspensions concentrated at a distance of 180 mm. below its point of suspension. The period of such a pendulum by the ordinary formula for a simple pendulum would be $0^s{\cdot}43$. The time of oscillation for either pendulum is

$t=\pi\sqrt{\frac{I}{Mgl}}$ in which I is the moment of inertia about the point of suspension, M is the mass, g is the force of gravity, and l is the distance from the point of suspension to the center of gravity. If the mass and moment of inertia of the beam itself in the actual case be neglected (which is allowable for the rough result here desired, the beam being a small mass as compared with the

*This is necessarily a weighted mean corresponding to the method of computation, which is here such that the first and fourth swings are given half weight.

pans and their loads), I and M become identical in the two cases. Whence it would follow that $\frac{l}{l_1}=\frac{(t')^2}{(t\ )^2}=\frac{d}{180^{mm}}=\frac{(0^s{\cdot}43)^2}{(52^s)^2}$ and d proves to be but 12 microns.

Or, starting with the known value of one division of scale in milligrammes, d may be computed from the static relations. One division of scale is 2 mm. in length, and the light traverses a distance of about 7 800 mm. in passing from the scale to the telescope by way of the mirrors on the beam. One division, therefore, represents a motion of the beam of $\frac{2}{7\ 800}=\frac{1}{3\ 900}$ expressed in radians. The observed mean value for one division is 0·043 mg., with a kilogramme on each pan. When the balance is in equilibrium with 1 kg. on one pan and 1 kg.+0·043 mg. on the other pan, the opposing moments being equal, $\frac{d}{3\ 900}(2\text{ kg.})\,g=(180\text{ mm.})\,(0{\cdot}043\text{ mg.})\,g$, if the mass of the beam and pans be neglected. This makes d=15 microns. This may be regarded as a superior limit for d, for if the computation were made more exact by considering the mass of the beam and pans, the computed value of d would necessarily become smaller.

The mean of the two values computed above is 14 microns. This is certainly not too small, since the assumptions in both cases were such as to make the computed d too great. The sensibility being proportional to d, the value of one scale division will change 0·0031 mg. $(=\frac{0{\cdot}043}{14})$ if d changes by a single micron. d necessarily varies almost exactly as does the distance from the middle knife-edge to the line joining the end knife-edges. d, then, varies directly with the elastic flexure of the beam and with distortions of the beam caused by differences of temperature in its different parts. It also depends intimately upon the perfection of all three of the principal knife-edges and the planes upon which they rest. As the computation of each separate weighing involves the reduction of from 0 to 25 scale divisions to absolute value by multiplying by a mean scale value which may easily differ by as much as 0·003 mg. (corresponding to 1 micron change in d) from the real scale value for that moment, it seems evident that here lies a second source from which may arise errors as large as ±0·0181 mg.

The actually observed variations in the scale value corroborate the statements of the last paragraph. Without any change whatever being made in the adjustments, successive groups of four weighings each gave the following values:

					Mg.	
February	1,	one	division of	scale	=0·044	
"	2	"	"	"	=0·044	
"	4–5	"	"	"	=0·048	Mean=0·043 mg.
"	14	"	"	"	=0·039	
"	15	"	"	"	=0·045	
"	18	"	"	"	=0·040	

This range of 0·009 mg. corresponds to a change of three microns in d. As this range is developed between values derived from sets of four weighings each, it seems probable that there was a still larger actual range during the individual weighings.

The arms of the balance are not quite equal. As at present adjusted, the zero is near the middle of the scale for a load of one kilogramme on each pan. But with nominally no loads upon the pans it requires about 12 mg. on the left pan to bring the zero to the same point. From this it appears that the left arm is about 2 microns longer than the right arm.

On February 19 the balance was set to swinging in the forenoon with a kilogramme on each pan and allowed to swing until it came to rest to give an idea of the amount of friction at the knife-edges. It swung for more than four hours after starting, with an initial oscillation of only twenty-one minutes of arc on each side of its equilibrium position.

We may compare the results from this Rueprecht balance with results obtained from similar Rueprecht balances at the International Bureau of Weights and Measures as follows:

Here the probable error of a single weighing, as derived from the interadjustment of various groups of weighings, is ±0·0236 mg., and each weighing consisted of but twelve readings of the

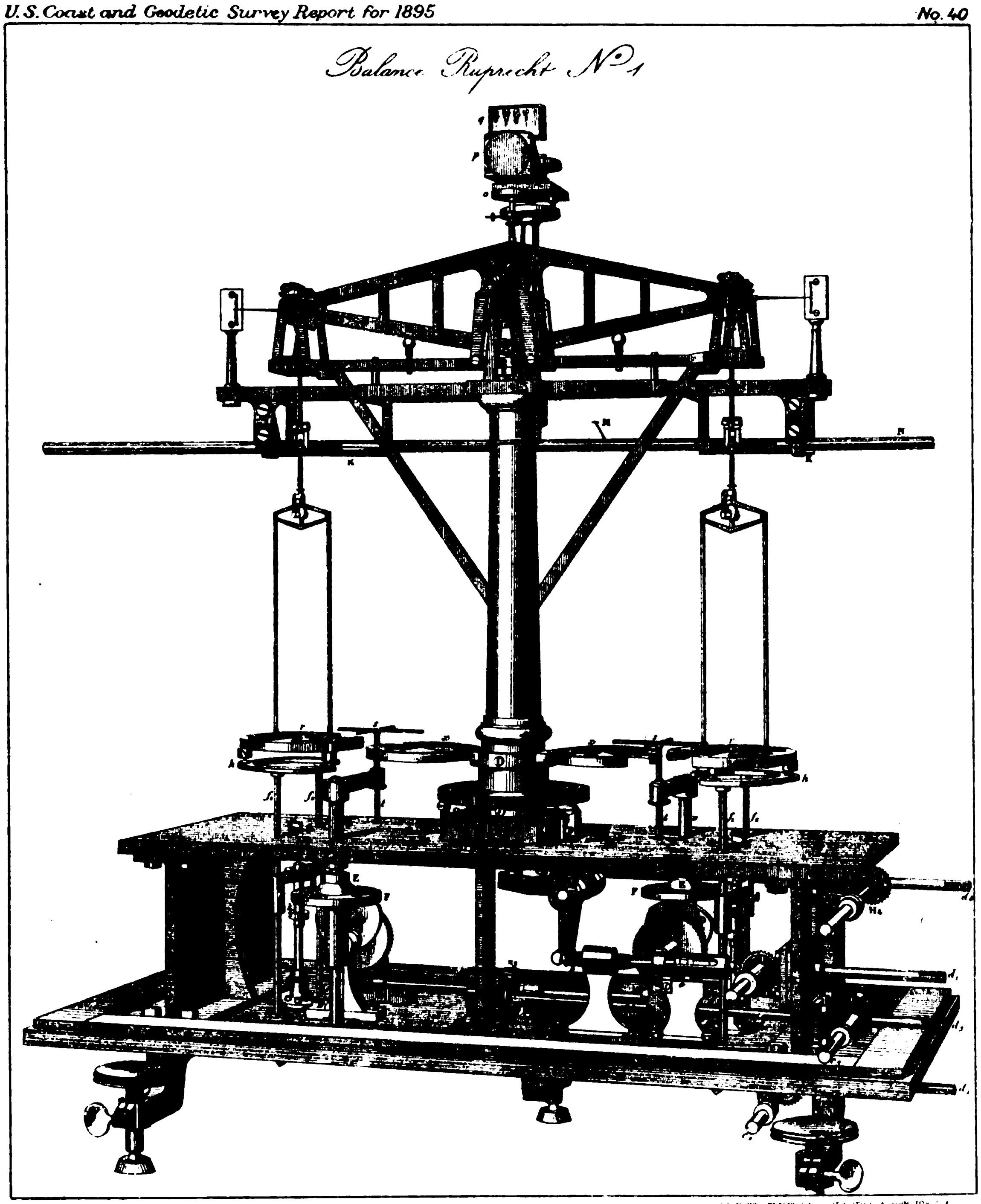
scale, and the weights were in four positions. Moreover, most of these weighings were made between brass and platinum, with a reduction to vacuo of about 90 mg.

M. W.-J. Marek, p. D. 79, Tome I, Travaux et Mémoires du Bureau International des Poids et Mesures, derives for the probable error of a single weighing ± 0.0081 mg. But this is derived from the individual groups, not from the interadjustment; the weights were all of platinum, or of platinum-iridium, and each weighing consisted of thirty-five readings of the scale and seven positions of the weights.

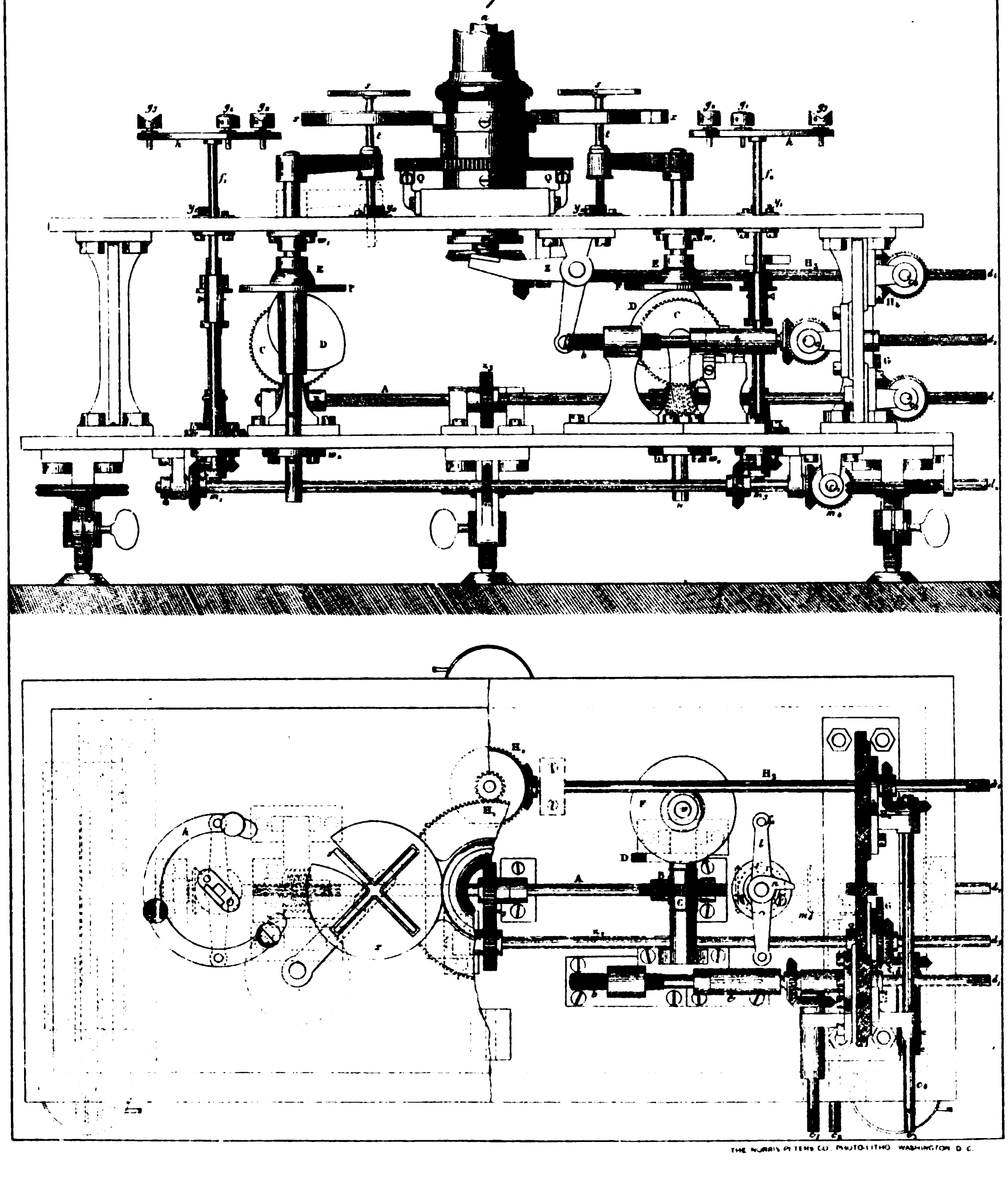
The weighings of the International Bureau, which served to determine the various national prototype kilogrammes, gave for the probable error of a single weighing on the Rueprecht balances ± 0.0067 mg. (See p. 107, "Rapport sur la Construction, les Comparaisons et les autres Opérations ayant servi à Déterminer les Équations des Nouveaux Prototypes Métriques.") This value is derived from the interadjustment of groups. But all the weights concerned were nearly of the same volume, and a "single weighing" consisted of one hundred and twenty-eight readings of the scale, and thirty-two positions of the weights, requiring at least four hours of work (not including waits) as contrasted with from twenty to forty minutes per weighing in the work just finished here.

In conclusion, it should be noted, in regard to the work here, that the errors arising from the balance proper are purely accidental in their nature and may easily be reduced to within 0·01 mg. per kilogramme; that, on the other hand, previous experience has shown that it is very difficult indeed to so effectually preserve a kilogramme weight against surface changes (abrasion, collection of dust, deposits of moisture or gases) that its mass shall remain constant within 0·01 mg.; that when a brass kilogramme is weighed against a platinum it requires the greatest care in obtaining the air temperature to insure that a constant error of as much as 0·01 mg. may not arise from this source; and finally, that in determining a brass kilogramme by weighing against a platinum standard the weakest step of all at present is the determination of the absolute barometric pressure.

The Rueprecht balance not only performs its functions so accurately as to require the greatest care in the determination of the temperature and pressure of air to insure that errors from this source shall not be greater than those from the balance proper, but, moreover, the combined errors of the balance and its auxiliary instruments are within limits narrower than those within which the surface changes of mass of the weights themselves can be certainly limited.


Balance Ruprecht No. 1

Balance Ruprecht No. 1



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APPENDIX No. 10—1895.

TABLES OF AZIMUTH AND APPARENT ALTITUDE OF POLARIS AT DIFFERENT HOUR ANGLES.

By G. R. PUTNAM, Assistant.

The accompanying tables* are intended for field use to facilitate placing an instrument in the meridian. They are also suitable for determining the approximate latitude or meridian. They contain the azimuth of Polaris at intervals of fifteen minutes in hour angle for each degree of north latitude from 30° to 60°, and the apparent altitude at the same intervals and for each fifth degree of latitude.† The tables are computed for the declination of Polaris 88° 46′, but the rate of change in both azimuth and altitude is given with the argument 1′ increase in declination.‡ The tables are intended to be used in connection with the American Ephemeris, where are given the apparent right ascension and declination of Polaris for each day in the year. The approximate local time will in general be known with sufficient accuracy from standard time and the approximate

* Similar tables, but without the corrections for change in declination, were published as Appendix XXII, Report U. S. Coast Survey for 1870. These were computed by Assistant George Davidson for north polar distance 1° 22′.

† The tables were computed with the following formulas:

$$\tan a = \frac{\sin t}{\cos \varphi \tan \delta - \sin \varphi \cos t}$$

$$\sin h = \sin \varphi \sin \delta + \cos \varphi \cos \delta \cos t$$

$$\sin a_e = \frac{\cos \delta}{\cos \varphi}$$

$$\cos t_e = \cot \delta \tan \varphi$$

where a = azimuth from true north
t = hour angle
φ = latitude
δ = declination
h = true altitude
a_e = azimuth at elongation
t_e = hour angle at elongation.

‡ As the corrections are given with proper sign for increase in declination over 88° 46′, they are to be applied with reversed sign while the declination is less than 88° 46′, as it will be until near the close of the century.

longitude of the place. The following example explains the use of the tables, and the derivation of the hour angle of Polaris:

Position, latitude 36° 20′ N., longitude 5^h 20^m 30^s W. of Greenwich.

	h.	m.	s.
Time of observation, July 10, 1895, standard (75th mer.) mean time	8	52	40 p. m.
Reduction to local time	—	20	30
Local mean time	8	32	10
Reduction to sidereal time (Table III, Amer. Ephem.)	+	1	24
Sidereal time mean noon, Greenwich, July 10, 1895	7	12	38
Correction for longitude, 5^h 20^m 30^s (Table III, Amer. Ephem.)	+	0	53
Local sidereal time	15	47	05
Apparent right ascension of Polaris, July 10, 1895	1	20	18
Hour angle before upper culmination	9	33	13

	°	′	″	
Declination of table	88	46		
Apparent declination, July 10, 1895	88	44	47	
Increase in declination		— 1	13	= —1′·2

	°	′	″		°	′
Values from tables (interpolated) azimuth	0	54	12	, apparent altitude	35	21·8
Correction for —1′·2 increase in declination			+52			—1·0
	0	55	04		35	20·8
	East of north.					

It is to be remembered that Polaris is east of the meridian for twelve hours before upper culmination, and west of the meridian for twelve hours after. By setting the instrument at the apparent altitude and sweeping near the meridian Polaris can ordinarily be found and the instrument placed in the meridian some time before dark. With transit instruments not provided with horizontal arc, the value of the azimuth adjusting screw may be readily determined and used.

Without the American Ephemeris these tables may be conveniently used for obtaining the approximate meridian or latitude, in connection with Bulletin 14, United States Coast and Geodetic Survey,* where are given the approximate mean times of culminations of Polaris, and the mean declinations for various epochs.

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* "APPROXIMATE TIMES OF CULMINATIONS AND ELONGATIONS AND OF THE AZIMUTHS AT ELONGATION OF POLARIS FOR THE YEARS BETWEEN 1889 AND 1910."

[Prepared for publication by Chas. A. Schott, **Assistant.**]

The mean places of Polaris are given as follows:

	α			δ		
	h.	*m.*	*s.*	°	′	″
1895	1	20	30.08	88	44	52·68
1900	1	22	33·76	88	46	26·66
1905	1	24	42·48	88	48	00·31
1910	1	26	56·58	88	49	33·61

Hour angle before or after upper culmination.	Azimuth of Polaris computed for declination 88° 46′.											Correction for 1′ increase in declination of Polaris.		Hour angle before or after upper culmination.
	Latitude 30°.	Latitude 31°.	Latitude 32°.	Latitude 33°.	Latitude 34°.	Latitude 35°.	Latitude 36°.	Latitude 37°.	Latitude 38°.	Latitude 39°.	Latitude 40°.	Latitude 30°.	Latitude 40°.	
h. m.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	″	″	*h. m.*
0 15	0 05 40	0 05 43	0 05 47	0 05 51	0 05 55	0 06 00	0 06 05	0 06 10	0 06 15	0 06 20	0 06 26	− 5	− 5	0 15
0 30	0 11 18	0 11 25	0 11 33	0 11 41	0 11 49	0 11 58	0 12 08	0 12 18	0 12 28	0 12 39	0 12 50	− 9	−10	0 30
0 45	0 16 53	0 17 04	0 17 15	0 17 27	0 17 40	0 17 53	0 18 07	0 18 22	0 18 38	0 18 54	0 19 11	−14	−16	0 45
1 00	0 22 23	0 22 38	0 22 53	0 23 09	0 23 26	0 23 44	0 24 02	0 24 22	0 24 43	0 25 04	0 25 27	−18	−21	1 00
1 15	0 27 48	0 28 06	0 28 25	0 28 45	0 29 06	0 29 28	0 29 51	0 30 15	0 30 41	0 31 08	0 31 36	−23	−26	1 15
1 30	0 33 05	0 33 26	0 33 49	0 34 13	0 34 38	0 35 04	0 35 31	0 36 00	0 36 31	0 37 02	0 37 36	−27	−31	1 30
1 45	0 38 13	0 38 38	0 39 04	0 39 32	0 40 00	0 40 30	0 41 02	0 41 35	0 42 11	0 42 47	0 43 26	−31	−36	1 45
2 00	0 43 12	0 43 40	0 44 09	0 44 40	0 45 12	0 45 46	0 46 22	0 47 00	0 47 39	0 48 21	0 49 04	−35	−40	2 00
2 15	0 47 58	0 48 29	0 49 02	0 49 36	0 50 12	0 50 50	0 51 29	0 52 11	0 52 55	0 53 41	0 54 29	−39	−45	2 15
2 30	0 52 32	0 53 06	0 53 42	0 54 19	0 54 59	0 55 40	0 56 23	0 57 09	0 57 57	0 58 47	0 59 40	−43	−49	2 30
2 45	0 56 52	0 57 29	0 58 07	0 58 48	0 59 30	1 00 15	1 01 02	1 01 51	1 02 43	1 03 37	1 04 34	−46	−53	2 45
3 00	1 00 58	1 01 37	1 02 18	1 03 01	1 03 46	1 04 34	1 05 24	1 06 17	1 07 12	1 08 10	1 09 12	−50	−57	3 00
3 15	1 04 47	1 05 28	1 06 12	1 06 58	1 07 46	1 08 36	1 09 29	1 10 25	1 11 24	1 12 25	1 13 30	−53	−60	3 15
3 30	1 08 19	1 09 02	1 09 48	1 10 36	1 11 27	1 12 20	1 13 16	1 14 14	1 15 16	1 16 21	1 17 29	−56	−63	3 30
3 45	1 11 33	1 12 18	1 13 06	1 13 56	1 14 49	1 15 45	1 16 43	1 17 44	1 18 49	1 19 57	1 21 08	−58	−66	3 45
4 00	1 14 28	1 15 15	1 16 05	1 16 57	1 17 52	1 18 50	1 19 50	1 20 54	1 22 01	1 23 11	1 24 25	−61	−69	4 00
4 15	1 17 04	1 17 52	1 18 44	1 19 37	1 20 34	1 21 34	1 22 36	1 23 42	1 24 51	1 26 03	1 27 20	−63	−72	4 15
4 30	1 19 19	1 20 09	1 21 02	1 21 57	1 22 55	1 23 57	1 25 01	1 26 08	1 27 19	1 28 33	1 29 52	−64	−74	4 30
4 45	1 21 14	1 22 05	1 22 59	1 23 55	1 24 55	1 25 57	1 27 03	1 28 12	1 29 24	1 30 40	1 32 00	−66	−75	4 45
5 00	1 22 48	1 23 40	1 24 35	1 25 32	1 26 32	1 27 36	1 28 42	1 29 52	1 31 06	1 32 23	1 33 44	−68	−76	5 00
5 15	1 24 00	1 24 53	1 25 48	1 26 46	1 27 47	1 28 51	1 29 59	1 31 09	1 32 24	1 33 42	1 35 04	−69	−77	5 15
5 30	1 24 51	1 25 44	1 26 40	1 27 38	1 28 39	1 29 44	1 30 52	1 32 03	1 33 18	1 34 37	1 35 59	−69	−78	5 30
5 45	1 25 20	1 26 13	1 27 09	1 28 07	1 29 09	1 30 14	1 31 21	1 32 33	1 33 48	1 35 07	1 36 30	−70	−78	5 45
6 00	1 25 27	1 26 19	1 27 15	1 28 14	1 29 15	1 30 20	1 31 27	1 32 39	1 33 54	1 35 13	1 36 35	−70	−78	6 00
6 15	1 25 12	1 26 04	1 26 59	1 27 57	1 28 59	1 30 03	1 31 10	1 32 21	1 33 36	1 34 54	1 36 16	−69	−78	6 15
6 30	1 24 34	1 25 27	1 26 21	1 27 19	1 28 19	1 29 23	1 30 30	1 31 40	1 32 54	1 34 11	1 35 32	−68	−77	6 30
6 45	1 23 36	1 24 27	1 25 21	1 26 18	1 27 17	1 28 20	1 29 26	1 30 35	1 31 48	1 33 04	1 34 24	−67	−76	6 45
7 00	1 22 16	1 23 06	1 23 59	1 24 55	1 25 53	1 26 55	1 27 59	1 29 07	1 30 18	1 31 33	1 32 52	−66	−75	7 00
7 15	1 20 35	1 21 25	1 22 16	1 23 10	1 24 08	1 25 08	1 26 11	1 27 17	1 28 26	1 29 39	1 30 56	−65	−73	7 15
7 30	1 18 34	1 19 22	1 20 12	1 21 05	1 22 00	1 22 59	1 24 00	1 25 04	1 26 12	1 27 23	1 28 38	−64	−72	7 30
7 45	1 16 13	1 16 59	1 17 48	1 18 39	1 19 33	1 20 29	1 21 28	1 22 30	1 23 36	1 24 45	1 25 57	−62	−69	7 45
8 00	1 13 33	1 14 17	1 15 04	1 15 53	1 16 45	1 17 39	1 18 36	1 19 36	1 20 39	1 21 45	1 22 54	−60	−66	8 00
8 15	1 10 34	1 11 16	1 12 01	1 12 48	1 13 37	1 14 29	1 15 24	1 16 21	1 17 22	1 18 25	1 19 31	−57	−64	8 15
8 30	1 07 17	1 07 57	1 08 40	1 09 25	1 10 12	1 11 01	1 11 53	1 12 48	1 13 45	1 14 45	1 15 48	−54	−61	8 30
8 45	1 03 43	1 04 22	1 05 02	1 05 44	1 06 29	1 07 15	1 08 04	1 08 56	1 09 50	1 10 47	1 11 47	−51	−58	8 45
9 00	0 59 54	1 00 30	1 01 07	1 01 47	1 02 29	1 03 12	1 03 58	1 04 47	1 05 38	1 06 31	1 07 27	−48	−54	9 00
9 15	0 55 49	0 56 23	0 56 58	0 57 34	0 58 13	0 58 54	0 59 37	1 00 22	1 01 09	1 01 59	1 02 51	−45	−50	9 15
9 30	0 51 31	0 52 01	0 52 34	0 53 08	0 53 43	0 54 21	0 55 00	0 55 42	0 56 25	0 57 11	0 57 59	−42	−46	9 30
9 45	0 46 59	0 47 27	0 47 57	0 48 28	0 49 00	0 49 34	0 50 10	0 50 48	0 51 27	0 52 09	0 52 53	−38	−42	9 45
10 00	0 42 16	0 42 42	0 43 08	0 43 36	0 44 05	0 44 35	0 45 08	0 45 42	0 46 17	0 46 54	0 47 34	−34	−38	10 00
10 15	0 37 23	0 37 45	0 38 08	0 38 33	0 38 59	0 39 26	0 39 54	0 40 24	0 40 55	0 41 28	0 42 03	−30	−34	10 15
10 30	0 32 20	0 32 39	0 32 59	0 33 20	0 33 43	0 34 06	0 34 30	0 34 57	0 35 24	0 35 52	0 36 22	−26	−29	10 30
10 45	0 27 09	0 27 25	0 27 42	0 28 00	0 28 18	0 28 38	0 28 59	0 29 20	0 29 43	0 30 07	0 30 32	−22	−24	10 45
11 00	0 21 51	0 22 04	0 22 18	0 22 32	0 22 47	0 23 03	0 23 19	0 23 37	0 23 55	0 24 14	0 24 35	−18	−20	11 00
11 15	0 16 28	0 16 38	0 16 48	0 16 59	0 17 10	0 17 22	0 17 35	0 17 48	0 18 02	0 18 16	0 18 31	−13	−15	11 15
11 30	0 11 01	0 11 08	0 11 14	0 11 22	0 11 29	0 11 37	0 11 46	0 11 54	0 12 04	0 12 13	0 12 23	− 9	−10	11 30
11 45	0 05 31	0 05 34	0 05 38	0 05 42	0 05 45	0 05 49	0 05 53	0 05 58	0 06 02	0 06 07	0 06 12	− 4	− 5	11 45
Elongation: Azimuth....	1 25 27	1 26 20	1 27 16	1 28 14	1 29 16	1 30 20	1 31 28	1 32 40	1 33 55	1 35 14	1 36 36	−69	−78	
	h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*s.*	
Hour angle.	5 57 09	5 57 02	5 56 55	5 56 48	5 56 40	5 56 33	5 56 25	5 56 17	5 56 09	5 56 00	5 55 52	+ 2	+ 3	

Hour angle before or after upper culmination.	Azimuth of Polaris computed for declination 88° 46′.											Correction for 1′ increase in declination of Polaris.		Hour angle before or after upper culmination.
	Latitude 40°.	Latitude 41°.	Latitude 42°.	Latitude 43°.	Latitude 44°.	Latitude 45°.	Latitude 46°.	Latitude 47°.	Latitude 48°.	Latitude 49°.	Latitude 50°.	Latitude 40°.	Latitude 50°.	
h. m.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	″	″	*h. m.*
0 15	0 06 26	0 06 32	0 06 39	0 06 45	0 06 52	0 07 00	0 07 08	0 07 16	0 07 25	0 07 34	0 07 44	− 5	− 6	0 15
0 30	0 12 50	0 13 03	0 13 15	0 13 29	0 13 43	0 13 58	0 14 13	0 14 30	0 14 48	0 15 06	0 15 25	−10	−13	0 30
0 45	0 19 11	0 19 30	0 19 48	0 20 08	0 20 29	0 20 52	0 21 15	0 21 40	0 22 06	0 22 33	0 23 02	−16	−19	0 45
1 00	0 25 27	0 25 51	0 26 16	0 26 43	0 27 10	0 27 40	0 28 11	0 28 44	0 29 18	0 29 55	0 30 33	−21	−25	1 00
1 15	0 31 36	0 32 05	0 32 36	0 33 09	0 33 44	0 34 21	0 34 59	0 35 40	0 36 23	0 37 08	0 37 56	−26	−32	1 15
1 30	0 37 36	0 38 11	0 38 48	0 39 27	0 40 09	0 40 52	0 41 38	0 42 26	0 43 17	0 44 11	0 45 08	−31	−38	1 30
1 45	0 43 26	0 44 07	0 44 50	0 45 35	0 46 22	0 47 12	0 48 05	0 49 01	0 49 59	0 51 02	0 52 07	−36	−43	1 45
2 00	0 49 04	0 49 50	0 50 39	0 51 29	0 52 23	0 53 19	0 54 19	0 55 22	0 56 28	0 57 38	0 58 52	−40	−49	2 00
2 15	0 54 29	0 55 20	0 56 14	0 57 10	0 58 10	0 59 12	1 00 18	1 01 28	1 02 4.	1 03 59	1 05 21	−45	−54	2 15
2 30	0 59 40	1 00 35	1 01 34	1 02 36	1 03 41	1 04 49	1 06 01	1 07 17	1 08 38	1 10 03	1 11 32	−49	−59	2 30
2 45	1 04 34	1 05 34	1 06 38	1 07 44	1 08 54	1 10 08	1 11 26	1 12 48	1 14 15	1 15 47	1 17 24	−53	−64	2 45
3 00	1 09 12	1 10 16	1 11 24	1 12 35	1 13 50	1 15 09	1 16 32	1 18 00	1 19 33	1 21 11	1 22 54	−57	−68	3 00
3 15	1 13 30	1 14 38	1 15 50	1 17 06	1 18 25	1 19 49	1 21 17	1 22 50	1 24 29	1 26 13	1 28 02	−60	−72	3 15
3 30	1 17 29	1 18 41	1 19 57	1 21 16	1 22 39	1 24 08	1 25 40	1 27 18	1 29 02	1 30 51	1 32 46	−63	−76	3 30
3 45	1 21 08	1 22 23	1 23 42	1 25 04	1 26 32	1 28 04	1 29 41	1 31 23	1 33 11	1 35 05	1 37 06	−66	−80	3 45
4 00	1 24 25	1 25 43	1 27 05	1 28 31	1 30 01	1 31 37	1 33 17	1 35 03	1 36 55	1 38 54	1 40 59	−69	−83	4 00
4 15	1 27 20	1 28 40	1 30 04	1 31 33	1 33 07	1 34 45	1 36 29	1 38 18	1 40 14	1 42 16	1 44 25	−72	−86	4 15
4 30	1 29 52	1 31 14	1 32 41	1 34 12	1 35 48	1 37 29	1 39 15	1 41 08	1 43 06	1 45 11	1 47 24	−74	−88	4 30
4 45	1 32 00	1 33 24	1 34 53	1 36 25	1 38 04	1 39 47	1 41 35	1 43 30	1 45 31	1 47 39	1 49 54	−75	−90	4 45
5 00	1 33 44	1 35 10	1 36 40	1 38 14	1 39 54	1 41 38	1 43 29	1 45 25	1 47 28	1 49 38	1 51 55	−76	−91	5 00
5 15	1 35 04	1 36 30	1 38 02	1 39 37	1 41 18	1 43 04	1 44 55	1 46 53	1 48 57	1 51 08	1 53 27	−77	−92	5 15
5 30	1 35 59	1 37 26	1 38 58	1 40 34	1 42 16	1 44 02	1 45 54	1 47 53	1 49 58	1 52 10	1 54 30	−78	−93	5 30
5 45	1 36 30	1 37 57	1 39 29	1 41 05	1 42 47	1 44 34	1 46 26	1 48 25	1 50 30	1 52 43	1 55 03	−78	−94	5 45
6 00	1 36 35	1 38 02	1 39 34	1 41 10	1 42 51	1 44 38	1 46 31	1 48 29	1 50 34	1 52 46	1 55 06	−78	−93	6 00
6 15	1 36 16	1 37 43	1 39 14	1 40 49	1 42 30	1 44 16	1 46 08	1 48 05	1 50 10	1 52 21	1 54 40	−78	−93	6 15
6 30	1 35 32	1 36 58	1 38 28	1 40 03	1 41 42	1 43 27	1 45 18	1 47 14	1 49 17	1 51 27	1 53 44	−77	−92	6 30
6 45	1 34 24	1 35 48	1 37 17	1 38 50	1 40 28	1 42 12	1 44 01	1 45 56	1 47 56	1 50 04	1 52 20	−76	−91	6 45
7 00	1 32 52	1 34 15	1 35 42	1 37 13	1 38 49	1 40 31	1 42 18	1 44 10	1 46 09	1 48 14	1 50 27	−75	−89	7 00
7 15	1 30 56	1 32 17	1 33 42	1 35 11	1 36 45	1 38 24	1 40 09	1 41 59	1 43 54	1 45 57	1 48 06	−73	−87	7 15
7 30	1 28 38	1 29 56	1 31 19	1 32 46	1 34 17	1 35 53	1 37 35	1 39 21	1 41 14	1 43 13	1 45 19	−72	−85	7 30
7 45	1 25 57	1 27 13	1 28 33	1 29 56	1 31 25	1 32 58	1 34 36	1 36 19	1 38 08	1 40 03	1 42 05	−69	−82	7 45
8 00	1 22 54	1 24 07	1 25 24	1 26 45	1 28 10	1 29 40	1 31 14	1 32 53	1 34 38	1 36 29	1 38 26	−66	−79	8 00
8 15	1 19 31	1 20 41	1 21 55	1 23 12	1 24 33	1 25 59	1 27 29	1 29 04	1 30 44	1 32 30	1 34 22	−64	−76	8 15
8 30	1 15 48	1 16 55	1 18 05	1 19 18	1 20 35	1 21 57	1 23 23	1 24 53	1 26 28	1 28 09	1 29 55	−61	−72	8 30
8 45	1 11 47	1 12 49	1 13 55	1 15 05	1 16 18	1 17 35	1 18 56	1 20 21	1 21 51	1 23 26	1 25 07	−58	−68	8 45
9 00	1 07 27	1 08 26	1 09 28	1 10 33	1 11 41	1 12 54	1 14 10	1 15 30	1 16 54	1 18 23	1 19 57	−54	−64	9 00
9 15	1 02 51	1 03 45	1 04 43	1 05 43	1 06 47	1 07 54	1 09 05	1 10 19	1 11 38	1 13 01	1 14 28	−50	−59	9 15
9 30	0 57 59	0 58 49	0 59 42	1 00 38	1 01 37	1 02 38	1 03 44	1 04 52	1 06 04	1 07 21	1 08 41	−46	−55	9 30
9 45	0 52 53	0 53 39	0 54 27	0 55 18	0 56 11	0 57 07	0 58 07	0 59 09	1 00 15	1 01 24	1 02 38	−42	−50	9 45
10 00	0 47 34	0 48 15	0 48 58	0 49 44	0 50 32	0 51 22	0 52 16	0 53 12	0 54 11	0 55 13	0 56 19	−38	−45	10 00
10 15	0 42 03	0 42 39	0 43 18	0 43 58	0 44 40	0 45 25	0 46 12	0 47 01	0 47 53	0 48 49	0 49 47	−34	−40	10 15
10 30	0 36 22	0 36 53	0 37 26	0 38 01	0 38 38	0 39 16	0 39 57	0 40 40	0 41 25	0 42 12	0 43 02	−29	−34	10 30
10 45	0 30 32	0 30 58	0 31 26	0 31 55	0 32 26	0 32 58	0 33 32	0 34 08	0 34 46	0 35 26	0 36 08	−24	−29	10 45
11 00	0 24 35	0 24 56	0 25 18	0 25 42	0 26 06	0 26 32	0 27 00	0 27 28	0 27 59	0 28 31	0 29 05	−20	−23	11 00
11 15	0 18 31	0 18 47	0 19 04	0 19 22	0 19 40	0 20 00	0 20 20	0 20 42	0 21 05	0 21 29	0 21 55	−15	−18	11 15
11 30	0 12 23	0 12 34	0 12 45	0 12 57	0 13 09	0 13 23	0 13 36	0 13 51	0 14 06	0 14 22	0 14 39	−10	−12	11 30
11 45	0 06 12	0 06 18	0 06 23	0 06 29	0 06 36	0 06 42	0 06 49	0 06 56	0 07 04	0 07 12	0 07 21	− 5	− 6	11 45
Elongation: Azimuth....	1 36 36	1 38 03	1 39 35	1 41 11	1 42 53	1 44 40	1 46 32	1 48 31	1 50 36	1 52 48	1 55 08	−78	−93	
	h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*h. m. s.*	*s.*	*s.*	
Hour angle.	5 55 52	5 55 43	5 55 34	5 55 24	5 55 14	5 55 04	5 54 53	5 54 42	5 54 31	5 54 20	5 54 07	+ 3	+ 5	

Hour angle before or after upper culmination.	Azimuth of Polaris computed for declination 88° 46′.											Correction for 1′ increase in declination of Polaris.		Hour angle before or after upper culmination.
	Latitude 50°.	Latitude 51°.	Latitude 52°.	Latitude 53°.	Latitude 54°.	Latitude 55°.	Latitude 56°.	Latitude 57°.	Latitude 58°.	Latitude 59°.	Latitude 60°.	Latitude 50°.	Latitude 60°.	
h. m.	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	″	″	h. m.
0 15	0 07 44	0 07 54	0 08 05	0 08 17	0 08 29	0 08 42	0 08 56	0 09 12	0 09 28	0 09 45	0 10 03	− 6	− 8	0 15
0 30	0 15 25	0 15 46	0 16 08	0 16 31	0 16 56	0 17 22	0 17 50	0 18 20	0 18 53	0 19 27	0 20 04	−13	− 17	0 30
0 45	0 23 02	0 23 33	0 24 06	0 24 41	0 25 18	0 25 57	0 26 39	0 27 24	0 28 12	0 29 03	0 29 58	−19	− 25	0 45
1 00	0 30 33	0 31 14	0 31 58	0 32 44	0 33 33	0 34 25	0 35 21	0 36 20	0 37 23	0 38 31	0 39 44	−25	− 33	1 00
1 15	0 37 56	0 38 47	0 39 40	0 40 38	0 41 38	0 42 43	0 43 52	0 45 06	0 46 24	0 47 48	0 49 19	−32	− 41	1 15
1 30	0 45 08	0 46 08	0 47 12	0 48 20	0 49 32	0 50 49	0 52 11	0 53 39	0 55 12	0 56 52	0 58 40	−38	− 49	1 30
1 45	0 52 07	0 53 17	0 54 31	0 55 49	0 57 12	0 58 41	1 00 16	1 01 56	1 03 44	1 05 40	1 07 44	−43	− 57	1 45
2 00	0 58 52	1 00 11	1 01 34	1 03 03	1 04 37	1 06 16	1 08 03	1 09 57	1 11 58	1 14 08	1 16 28	−49	− 64	2 00
2 15	1 05 21	1 06 48	1 08 21	1 09 59	1 11 43	1 13 33	1 15 31	1 17 37	1 19 52	1 22 16	1 24 51	−54	− 71	2 15
2 30	1 11 32	1 13 08	1 14 48	1 16 35	1 18 29	1 20 30	1 22 39	1 24 56	1 27 24	1 30 01	1 32 50	−59	− 78	2 30
2 45	1 17 24	1 19 07	1 20 55	1 22 51	1 24 54	1 27 04	1 29 23	1 31 52	1 34 31	1 37 21	1 40 23	−64	− 84	2 45
3 00	1 22 54	1 24 44	1 26 41	1 28 44	1 30 55	1 33 15	1 35 43	1 38 22	1 41 12	1 44 13	1 47 28	−68	− 89	3 00
3 15	1 28 02	1 29 59	1 32 02	1 34 13	1 36 32	1 39 00	1 41 37	1 44 25	1 47 25	1 50 37	1 54 03	−72	− 94	3 15
3 30	1 32 46	1 34 49	1 36 58	1 39 16	1 41 42	1 44 18	1 47 03	1 50 00	1 53 08	1 56 30	2 00 07	−76	− 99	3 30
3 45	1 37 06	1 39 14	1 41 29	1 43 52	1 46 25	1 49 07	1 52 00	1 55 04	1 58 21	2 01 51	2 05 37	−80	−104	3 45
4 00	1 40 59	1 43 12	1 45 32	1 48 01	1 50 39	1 53 27	1 56 26	1 59 37	2 03 01	2 06 40	2 10 34	−83	−108	4 00
4 15	1 44 25	1 46 42	1 49 07	1 51 40	1 54 23	1 57 16	2 00 21	2 03 38	2 07 09	2 10 54	2 14 55	−86	−111	4 15
4 30	1 47 24	1 49 44	1 52 13	1 54 50	1 57 37	2 00 35	2 03 44	2 07 06	2 10 42	2 14 32	2 18 39	−88	−114	4 30
4 45	1 49 54	1 52 17	1 54 49	1 57 29	2 00 20	2 03 21	2 06 34	2 10 00	2 13 40	2 17 35	2 21 47	−90	−116	4 45
5 00	1 51 55	1 54 21	1 56 54	1 59 37	2 02 31	2 05 35	2 08 51	2 12 20	2 16 03	2 20 02	2 24 17	−91	−118	5 00
5 15	1 53 27	1 55 54	1 58 29	2 01 15	2 04 10	2 07 16	2 10 34	2 14 05	2 17 50	2 21 51	2 26 09	−92	−119	5 15
5 30	1 54 30	1 56 58	1 59 34	2 02 20	2 05 16	2 08 23	2 11 42	2 15 14	2 19 01	2 23 04	3 27 23	−93	−120	5 30
5 45	1 55 03	1 57 31	2 00 08	2 02 53	2 05 50	2 08 58	2 12 17	2 15 50	2 19 36	2 23 39	2 27 58	−94	−120	5 45
6 00	1 55 06	1 57 34	2 00 10	2 02 56	2 05 52	2 08 58	2 12 17	2 15 49	2 19 35	2 23 37	2 27 56	−93	−120	6 00
6 15	1 54 40	1 57 06	1 59 41	2 02 26	2 05 21	2 08 26	2 11 44	2 15 14	2 18 59	2 22 59	2 27 15	−93	−119	6 15
6 30	1 53 44	1 56 09	1 58 43	2 01 25	2 04 18	2 07 22	2 10 37	2 14 05	2 17 47	2 21 44	2 25 57	−92	−118	6 30
6 45	1 52 20	1 54 42	1 57 14	1 59 54	2 02 44	2 05 45	2 08 57	2 12 21	2 16 00	2 19 53	2 24 03	−91	−116	6 45
7 00	1 50 27	1 52 47	1 55 15	1 57 52	2 00 39	2 03 36	2 06 44	2 10 05	2 13 39	2 17 27	2 21 32	−89	−114	7 00
7 15	1 48 06	1 50 23	1 52 48	1 55 21	1 58 04	2 00 57	2 04 00	2 07 16	2 10 45	2 14 27	2 18 26	−87	−111	7 15
7 30	1 45 19	1 47 32	1 49 52	1 52 21	1 54 59	1 57 47	2 00 45	2 03 55	2 07 18	2 10 54	2 14 46	−85	−108	7 30
7 45	1 42 05	1 44 13	1 46 29	1 48 53	1 51 26	1 54 08	1 57 00	2 00 04	2 03 20	2 06 49	2 10 32	−82	−104	7 45
8 00	1 38 26	1 40 29	1 42 40	1 44 58	1 47 25	1 50 01	1 52 47	1 55 43	1 58 52	2 02 12	2 05 47	−79	−100	8 00
8 15	1 34 22	1 36 20	1 38 25	1 40 38	1 42 58	1 45 27	1 48 06	1 50 54	1 53 54	1 57 06	2 00 32	−76	− 96	8 15
8 30	1 29 55	1 31 48	1 33 47	1 35 52	1 38 06	1 40 28	1 42 58	1 45 39	1 48 30	1 51 32	1 54 47	−72	− 91	8 30
8 45	1 25 07	1 26 53	1 28 45	1 30 44	1 32 50	1 35 04	1 37 26	1 39 57	1 42 39	1 45 31	1 48 35	−68	− 86	8 45
9 00	1 19 57	1 21 37	1 23 22	1 25 13	1 27 11	1 29 17	1 31 30	1 33 51	1 36 23	1 39 05	1 41 57	−64	− 80	9 00
9 15	1 14 28	1 16 01	1 17 38	1 19 22	1 21 12	1 23 08	1 25 12	1 27 24	1 29 44	1 32 14	1 34 55	−59	− 75	9 15
9 30	1 08 41	1 10 06	1 11 36	1 13 12	1 14 53	1 16 40	1 18 34	1 20 36	1 22 45	1 25 03	1 27 30	−55	− 69	9 30
9 45	1 02 38	1 03 55	1 05 17	1 06 44	1 08 16	1 09 53	1 11 37	1 13 28	1 15 25	1 17 31	1 19 45	−50	− 63	9 45
10 00	0 56 19	0 57 28	0 58 42	1 00 00	1 01 23	1 02 50	1 04 23	1 06 03	1 07 48	1 09 41	1 11 41	−45	− 56	10 00
10 15	0 49 47	0 50 48	0 51 53	0 53 02	0 54 15	0 55 32	0 56 54	0 58 22	0 59 55	1 01 34	1 03 20	−40	− 50	10 15
10 30	0 43 02	0 43 56	0 44 52	0 45 51	0 46 54	0 48 01	0 49 12	0 50 27	0 51 48	0 53 14	0 54 45	−34	− 43	10 30
10 45	0 36 08	0 36 52	0 37 39	0 38 29	0 39 22	0 40 18	0 41 18	0 42 21	0 43 28	0 44 40	0 45 57	−29	− 36	10 45
11 00	0 29 05	0 29 41	0 30 18	0 30 58	0 31 41	0 32 26	0 33 14	0 34 05	0 34 59	0 35 57	0 36 59	−23	− 29	11 00
11 15	0 21 55	0 22 22	0 22 50	0 23 20	0 23 52	0 24 26	0 25 02	0 25 41	0 26 21	0 27 05	0 27 51	−18	− 22	11 15
11 30	0 14 39	0 14 57	0 15 16	0 15 37	0 15 58	0 16 21	0 16 45	0 17 10	0 17 38	0 18 07	0 18 38	−12	− 14	11 30
11 45	0 07 21	0 07 30	0 07 39	0 07 49	0 08 00	0 08 11	0 08 23	0 08 36	0 08 50	0 09 04	0 09 20	− 6	− 7	11 45
Elongation:														
Azimuth....	1 55 08	1 57 36	2 00 13	2 02 59	2 05 55	2 09 02	2 12 21	2 15 54	2 19 40	2 23 43	2 28 02	−93	−120	
	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	s.	s.	
Hour angle.	5 54 07	5 53 54	5 53 41	5 53 27	5 53 12	5 52 57	5 52 41	5 52 24	5 52 06	5 51 47	5 51 27	+ 5	+ 7	

Hour angle before or after upper culmination.	Apparent altitude of Polaris, computed for declination 88° 46′ and mean refraction. Latitude 30°.	Latitude 35°.	Latitude 40°.	Latitude 45°.	Latitude 50°.	Latitude 55°.	Latitude 60°.	Correction for 1′ increase in declination of Polaris.	Hour angle before or after upper culmination.
h. m.	° ′	° ′	° ′	° ′	° ′	° ′	° ′	′	h. m.
0 00	31 15.6	36 15.3	41 15.1	46 14.9	51 14.8	56 14.6	61 14.5	−1.0	0 00
0 15	31 15.4	36 15.2	41 14.9	46 14.8	51 14.6	56 14.4	61 14.3	−1.0	0 15
0 30	31 14.9	36 14.7	41 14.5	46 14.3	51 14.2	56 14.0	61 13.8	−1.0	0 30
0 45	31 14.2	36 13.9	41 13.7	46 13.5	51 13.3	56 13.2	61 13.0	−1.0	0 45
1 00	31 13.0	35 12.8	41 12.5	46 12.3	51 12.2	56 12.0	61 11.9	−1.0	1 00
1 15	31 11.6	36 11.3	41 11.1	46 10.9	51 10.8	56 10.6	61 10.4	−0.9	1 15
1 30	31 09.9	36 09.6	41 09.4	46 09.2	51 09.0	56 08.8	61 08.6	−0.9	1 30
1 45	31 07.9	36 07.6	41 07.3	46 07.2	51 07.0	56 06.8	61 06.6	−0.9	1 45
2 00	31 05.6	36 05.3	41 05.0	46 04.8	51 04.6	56 04.4	61 04.2	−0.8	2 00
2 15	31 03.0	36 02.7	41 02.4	46 02.2	51 02.0	56 01.8	61 01.6	−0.8	2 15
2 30	31 00.1	35 59.8	40 59.5	45 59.3	50 59.1	55 58.9	60 58.7	−0.8	2 30
2 45	30 57.0	35 56.7	40 56.5	45 56.2	50 56.0	55 55.8	60 55.5	−0.7	2 45
3 00	30 53.7	35 53.4	40 53.1	45 52.9	50 52.6	55 52.3	60 52.1	−0.7	3 00
3 15	30 50.1	35 49.8	40 49.5	45 49.2	50 49.0	55 48.8	60 48.5	−0.6	3 15
3 30	30 46.4	35 46.0	40 45.7	45 45.5	50 45.2	55 45.0	60 44.7	−0.6	3 30
3 45	30 42.4	35 42.1	40 41.8	45 41.5	50 41.3	55 41.0	60 40.7	−0.5	3 45
4 00	30 38.3	35 38.0	40 37.6	45 37.4	50 37.1	55 36.8	60 36.5	−0.5	4 00
4 15	30 34.0	35 33.6	40 33.3	45 33.0	50 32.8	55 32.5	60 32.1	−0.4	4 15
4 30	30 29.6	35 29.2	40 28.9	45 28.5	50 28.3	55 28.0	60 27.6	−0.4	4 30
4 45	30 25.0	35 24.6	40 24.3	45 24.0	50 23.7	55 23.4	60 23.0	−0.3	4 45
5 00	30 20.4	35 20.0	40 19.7	45 19.4	50 19.1	55 18.8	60 18.4	−0.2	5 00
5 15	30 15.6	35 15.3	40 14.9	45 14.6	50 14.3	55 14.0	60 13.6	−0.2	5 15
5 30	30 10.8	35 10.4	40 10.1	45 09.9	50 09.6	55 09.2	60 08.8	−0.1	5 30
5 45	30 06.0	35 05.6	40 05.3	45 05.0	50 04.7	55 04.4	60 04.0	0.0	5 45
6 00	30 01.2	35 00.8	40 00.5	45 00.2	49 59.9	54 59.5	59 59.1	0.0	6 00
6 15	29 56.4	34 56.0	39 55.6	44 55.3	49 55.0	54 54.7	59 54.3	+0.1	6 15
6 30	29 51.6	34 51.2	39 50.8	44 50.5	49 50.2	54 49.9	59 49.6	+0.1	6 30
6 45	29 46.8	34 46.4	39 46.0	44 45.7	49 45.5	54 45.1	59 44.8	+0.2	6 45
7 00	29 42.1	34 41.7	39 41.4	44 41.1	49 40.8	54 40.4	59 40.1	+0.3	7 00
7 15	29 37.5	34 37.1	39 36.8	44 36.4	49 36.2	54 35.8	59 35.4	+0.4	7 15
7 30	29 33.0	34 32.6	39 32.3	44 32.0	49 31.7	54 31.4	59 31.0	+0.4	7 30
7 45	29 28.6	34 28.2	39 27.9	44 27.6	49 27.3	54 27.0	59 26.7	+0.5	7 45
8 00	29 24.4	34 24.0	39 23.7	44 23.4	49 23.1	54 22.8	59 22.5	+0.5	8 00
8 15	29 20.3	34 19.9	39 19.6	44 19.3	49 19.0	54 18.8	59 18.4	+0.6	8 15
8 30	29 16.4	34 16.0	39 15.7	44 15.4	49 15.2	54 14.9	59 14.6	+0.6	8 30
8 45	29 12.7	34 12.3	39 12.0	44 11.7	49 11.5	54 11.2	59 11.0	+0.7	8 45
9 00	29 09.2	34 08.8	39 08.5	44 08.3	49 08.1	54 07.9	59 07.6	+0.7	9 00
9 15	29 05.9	34 05.5	39 05.3	44 05.0	49 04.8	54 04.5	59 04.3	+0.8	9 15
9 30	29 02.8	34 02.5	39 02.2	44 02.0	49 01.8	54 01.5	59 01.3	+0.8	9 30
9 45	29 00.0	33 59.7	38 59.4	43 59.2	48 59.0	53 58.8	58 58.6	+0.8	9 45
10 00	28 57.5	33 57.2	38 56.9	43 56.7	48 56.6	53 56.4	58 56.1	+0.9	10 00
10 15	28 55.3	33 55.0	38 54.7	43 54.5	48 54.3	53 54.1	58 53.9	+0.9	10 15
10 30	28 53.3	33 53.0	38 52.8	43 52.5	48 52.4	53 52.1	58 52.0	+0.9	10 30
10 45	28 51.6	33 51.3	38 51.1	43 50.8	48 50.7	53 50.5	58 50.3	+0.9	10 45
11 00	28 50.2	33 49.9	38 49.7	43 49.5	48 49.4	53 49.1	58 49.0	+1.0	11 00
11 15	28 49.2	33 48.9	38 48.6	43 48.4	48 48.2	53 48.0	58 47.9	+1.0	11 15
11 30	28 48.4	33 48.1	38 47.8	43 47.6	48 47.5	53 47.2	58 47.1	+1.0	11 30
11 45	28 47.9	33 47.6	38 47.4	43 47.1	48 47.0	53 46.8	58 46.7	+1.0	11 45
12 00	28 47.7	33 47.4	38 47.2	43 47.0	48 46.8	53 46.7	58 46.6	+1.0	12 00

APPENDIX No. 11—1895.

SUBDIVISION I.

LIST OF ORIGINAL TOPOGRAPHIC SHEETS, GEOGRAPHICALLY ARRANGED, REGISTERED IN THE ARCHIVES OF THE UNITED STATES COAST AND GEODETIC SURVEY,

FROM

JANUARY, 1834, TO DECEMBER 31, 1895.

NOS. 1 TO 2209, INCLUSIVE.

UNITED STATES COAST AND GEODETIC SURVEY.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, from January, 1834, to December 31, 1895.

NOS. 1 TO 2209, INCLUSIVE.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Northeastern boundary, from Initial Monument to the mouth of the St. Croix River, including Passamaquoddy Bay.				
Maine and New Brunswick.	Monument Stream, from Initial Monument to Greenleaf Brook.	2103	1-10,000	S. Forney	1892.
Do	North Lake and Monument Stream, northeastern boundary.	2102	1-10,000	.....do	1892.
Do	Grand Lake (upper part), northeastern boundary	2048	1-10,000	J. Hergesheimer	1891.
Do	Grand Lake (middle part), northeastern boundary	2049	1-10,000	.....do	1891.
Do	Grand Lake (southern end and arm of), northeastern boundary.	2050	1-10,000	J. Hergesheimer and S. Forney.	1891-92.
Do	Chiputneticook Lake (northern end), northeastern boundary.	2101	1-10,000	S. Forney	1892.
Do	Chiputneticook Lake (upper part), northeastern boundary.	2040	1-10,000	J. A. Flemer	1891.
Do	Chiputneticook Lake (middle part), northeastern boundary.	2038	1-10,000	.....do	1891.
Do	Chiputneticook Lake (lower part), northeastern boundary.	2037	1-10,000	.....do	1891.
Do	St. Croix River, traverse line, with topography from Vanceboro to Elbow Rip.	1931	1-40,000	C. M. Bache	1889.
Do	St. Croix River, traverse line, with topography from Elbow Rip to Meetinghouse Rips.	2000	1-10,000	J. A. Flemer	1890.
Do	St. Croix River, traverse line, with topography from Meetinghouse Rips to the Pondwalk.	2001	1-10,000	.....do	1890.
Do	St. Croix River, traverse line, with topography from Pondwalk to Weatherbys Clearing.	2003	1-10,000	.....do	1890.
Do	St. Croix River, traverse line, with topography from Weatherbys Clearing to Ryans Rip.	2006	1-10,000	.....do	1890.
Do	St. Croix River, traverse line, with topography from Ryans Rip to Calais.	1940	1-10,000	E. Ellicott	1889.
Do	St. Croix River, Calais to Devils Head	1150	1-10,000	W. H. Dennis	1869.
Do	St. Croix River, Devils Head to Robbinstown	1828	1-10,000	.....do	1866.
Maine	St. Croix River, right bank, Devils Head to Mill Cove.	1669	1-10,000	A. W. Longfellow and C. M. Bache	1885-88.
Do	St. Croix River, right bank of, Mill Cove to Lewis Cove.	1863	1-10,000	C. M. Bache	1888.
Do	West shore Passamaquoddy Bay, Lewis Cove to Little River.	1864	1-10,000	.....do	1888.
New Brunswick	St. Andrews Harbor, shore line	1839	1-10,000	W. H. Dennis	1865.
Maine and New Brunswick.	Passamaquoddy Bay, shore line	1841	1-20,000	.....do	1866.
New Brunswick	Passamaquoddy Bay, north shore of Deer Island	1840	1-10,000	.....do	1866.
Maine	Passamaquoddy Bay, Pleasant Point to Boydens Lake.	1932	1-10,000	J. H. Gray	1889.
	Eastport and approaches, from Deadman Head, New Brunswick, to West Quoddy Head, Maine, including Cobscook Bay.				
New Brunswick	Deadman Head to Deer Island, including Letite Passage.	1007	1-10,000	W. H. Dennis	1865.
Do	East shore of Deer Isle and north shore of Campobello Island.	981	1-10,000	.....do	1861-62-63.
Maine and New Brunswick.	Pleasant Point to Lubec, includinug Eastport	979	1-10,000	.....do	1861-65.
Maine	North Lubec, part of Sewards Neck	1933	1-10,000	J. W. Donn	1889.
Maine and New Brunswick.	West Quoddy Bay	980	1-10,000	W. H. Dennis and E. Ellicott.	1861-63-88.
Do	Sheet showing northeastern water boundary, vicinity of Eastport.	2173	1-10,000	D. B. Wainwright	1894.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Eastport and approaches, from Deadman Head, New Brunswick, to West Quoddy Head, Maine, including Cobscook Bay—Continued.				
Maine	Cobscook Bay, northern part, Pennamaquan River and Pembroke.	1859	1-10,000	E. Ellicott	1888.
Do	Cobscook Bay, northwestern part, Dennysville	1838	1-10,000	J. H. Gray	1888.
Do	Cobscook Bay, southwestern part, Whiting	1780	1-10,000	....do	1887.
Do	Cobscook Bay, south shore, West Lubec	1805	1-10,000	E. Ellicott	1887.
Do	Porcupine Hills, West Lubec to Lilly Lake and Trescotts Rock.	1935	1-10,000	J. W. Donn	1889.
	West Quoddy Head to Frenchmans Bay.				
Maine	West Quoddy Head to Moose Cove	1741	1-10,000	E. Ellicott	1886.
Do	Moose Cove to Schooner Brook	1664	1-10,000	....do	1885.
Do	Little River to Cross Island, including Little Machias Bay.	1665	1-10,000	....do	1885.
Do	Machias Bay entrance	1543	1-10,000	C. H. Boyd	1882-84.
Do	Machiasport and vicinity	1540	1-10,000	....do	1883-84.
Do	Machias and vicinity	1739	1-10,000	....do	1885-86.
Do	Little Kennebec Harbor and River	1670	1-10,000	....do	1883-85.
Do	Englishmans Bay to Rodgers Island	1666	1-10,000	E. Ellicott	1885.
Do	Chandlers Bay and Chandlers River, includiug village of Jonesboro.	1536	1-10,000	....do	1883-84.
Do	Moose-a-bec Reach (upper sheet)	1172	1-10,000	J. W. Donn	1870.
Do	Outer edge of the Moose-a-bec Island	1501	1-10,000	E. Ellicott	1882.
Do	Moose-a-bec Reach (middle sheet)	1171	1-10,000	J. W. Donn	1870.
Do	Moose-a-bec Reach (lower sheet)	1173	1-10,000	....do	1870.
Do	Shores of Pleasant Bay and River, Cape Split to Addison Point.	1524	1-10,000	C. H. Boyd	1881.
Do	The valley of Pleasant River from Addison to Columbia Falls.	1506	1-10,000	A. W. Longfellow	1882.
Do	Shores of Harrington River and Bay	1521	1-10,000	W. H. Dennis and E. Ellicott.	1881-83.
Do	The Narraguagus Valley from Millbridge to Cherryfield.	1519	1-10,000	A. W. Longfellow	1881.
Do	Vicinity of Millbridge	1496 *b*	1-10,000	C. H. Hosmer	1881.
Do	Main shore and islands of Narraguagus Bay and Pigeon Hill Bay.	1496 *a*	1-10,000	....do	1881.
Do	Dyers Neck and Petit Manan Point	1486	1-10,000	H. G. Ogden	1880.
Do	Goldsboro Bay	1039	1-10,000	C. Rockwell and E. F. Dickins.	1865-84.
Do	Winter Harbor to Goldsboro Bay	1040	1-10,000	C. Rockwell, E. F. Dickins, and W. I. Vinal.	1865-83-84.
	Frenchmans Bay and Blue Hill Bay.				
Maine	Egg Rock, entrance of Frenchmans Bay	1334 *c*	1-5,000	J. W. Donn and F. C. Donn.	1874.
Do	Long and Burnt Porcupine Islands, Frenchmans Bay.	1479	1-10,000	C. Hosmer	1878.
Do	East side of Frenchmans Bay from Waukeag Neck to Winter Harbor.	891	1-10,000	C. Rockwell and W. I. Vinal.	1862-83.
Do	Head of Frenchmans Bay and part of Franklin Bay	1491	1-10,000	H. G. Ogden	1879.
Do	Taunton and Hog bays	1492	1-10,000	A. W. Longfellow	1880.
Do	Skillings River	1487	1-10,000	C. Hosmer and H. G. Ogden.	1877-78-79.
Do	Union River Bay to Skillings River, including Jordans River and Lamoine.	1522	1-10,000	A. W. Longfellow	1879-80.
Do	Mount Desert Island, Sands Point to High Head	1365	1-10,000	J. W. Donn	1874.
Do	Mount Desert Island (interior), from Hulls Cove to Pretty Marsh.	1364	1-10,000	....do	1874.
Do	Mount Desert Island, northeastern part	1334 *b*	1-10,000	....do	1873.
Do	Mount Desert Island, Bar Harbor village	1541	1-10,000	A. W. Longfellow and E. F. Dickins.	1884.
Do	Mount Desert Island, southeastern part	1334 *a*	1-10,000	J. W. Donn	1873.
Do	Mount Desert Island, northeast and southeast harbors.	1243	1-10,000	....do	1871.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Frenchmans Bay and Blue Hill Bay—Continued.				
Maine	Great and Little Cranberry islands and Suttons Island.	1244	1-10,000	J. W. Donn	1871.
Do	Bakers Island	463	1-2,500	W. E. Greenwell	1854.
Do	Mount Desert Island, southwestern part, from Bass Head to Seal Cove.	1281	1-10,000	J. W. Donn	1872.
Do	Mount Desert Island, western part	1282	1-10,000	....do	1872.
Do	Bartletts Island, Blue Hill Bay	1490	1-10,000	H. G. Ogden	1878.
Do	Head of Union River Bay, with Pattens Bay and Union River, to and including city of Ellsworth.	1494	1-10,000	A. W. Longfellow	1878-79.
Do	Head of Blue Hill Bay, with Newbury Neck and part of West Trenton.	1451	1-10,000	....do	1877.
Do	West shore of Blue Hill Bay	1428	1-10,000	W. H. Dennis	1875.
Do	Western part of Long Island, Blue Hill Bay	1489 *a*	1-10,000	H. G. Ogden	1878.
Do	Eastern part of Long Island, Blue Hill Bay	1489 *b*	1-10,000	....do	1878.
Do	Black, Pond, Calf, Ship, Bar, Tinkers, Hardwood, and adjacent islands.	1397 *b*	1-10,000	J. W. Donn	1875.
Do	Swan Island	1396	1-10,000	....do	1875.
Do	Long, Black, Placentia, Otter, Johns, and Gotts islands.	1397 *a*	1-10,000	F. C. Donn	1875.
Do	Islands lying south of Mount Desert Island	1245	1-10,000	J. W. Donn	1871.
Do	Eastern shore of Eggemoggin Reach	1379 *b*	1-10,000	W. H. Dennis	1874.
	Penobscot Bay.				
Maine	East coast of Eggemoggin Reach	1286 *b*	1-10,000	C. Hosmer and W. H. Dennis.	1872-74.
Do	Northern part of Deer Island	1379 *a*	1-10,000	W. H. Dennis	1873-74.
Do	Southern part of Deer Island and vicinity, Penobscot Bay.	1297	1-10,000	.... do	1872.
Do	Islands in Jericho Bay south of Naskeag Point	1383 *b*	1-10,000	J. N. McClintock	1874.
Do	Heron Island and outlying ledges off Newhalls	1351 *bis*	1-10,000	J. F. Moser	1877.
Do	Islands in Jericho Bay	1351	1-10,000	J. N. McClintock	1874.
Do	Ledges in Jericho Bay, southeast of Isle au Haut	1383 *c*	1-10,000	....do	1874.
Do	Isle au Haut and adjacent islands	1311	1-10,000	....do	1872.
Do	Islands in Isle au Haut Bay	1383 *a*	1-20,000	....do	1874.
Do	Scrag Island and ledges, southeast of Marsh Island Light-house.	1383 *d*	1-10,000	.... do	1874.
Do	Smith, Saddleback, and Brownstone islands and adjacent ledges.	1157 *b*	1-10,000	H. M. De Wees	1870.
Do	Southern portion of Fox Island group and adjacent islands and ledges.	1157 *a*	1-10,000	....do	1870-71.
Do	Fox Island group, embracing western part of Vinal Haven Island.	1093	1-10,000	F. W. Dorr	1868.
Do	Northern part of Vinal Haven Island	1075	1-10,000	....do	1868.
Do	North Haven Island, including ledges and islands north of Main and Little Thoroughfares.	1072	1-10,000	....do	1867.
Do	Islands in Penobscot Bay, north of Northern Fox	1350 *a*	1-10,000	J. N. McClintock	1873-74.
Do	Islands in Penobscot Bay, south of Cape Rosier	1350 *b*	1-10,000	....do	1873-74.
Do	North part of Eggemoggin Reach	1286 *a*	1-10,000	C. Hosmer and W. H. Dennis.	1872-74.
Do	Shores of Bagaduce River, from the bridge south, including Brooksville and Welkers Pond.	1405 *b*	1-10,000	H. Adams	1875.
Do	Cape Rosier, a part of Brooksville	1330	1-10,000	A. W. Longfellow	1872-73.
Do	Bagaduce River, from the mouth to the bridge	1372	1-10,000	H. Adams	1874.
Do	Castine and part of Penobscot	1377	1-10,000	A. W. Longfellow	1874.
Do	Shores of Northern Bay, head of Bagaduce River, and town of Penobscot.	1405 *a*	1-10,000	H. Adams	1875.
Do	Eastern shore of Penobscot River, Whitmores Island to Moores Cove.	1357 *b*	1-10,000	J. Hergesheimer	1874.
Do	Penobscot River, Indian Point to Sandy Point, including Bucksport, Whitmores Island, and Eastern River.	1357 *a*	1-10,000	....do	1873-74.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Penobscot Bay—Continued.				
Maine	Penobscot River, Indian Point to Parkers Point, including Prospect River.	1309	1-10,000	F. W. Dorr	1873.
Do	From Winterport to Hampden, with part of Bucksport and Orrington.	1421	1-10,000	A. W. Longfellow	1875.
Do	Penobscot River, from Hampden to Bangor, with part of Orrington and Brewer.	1434	1-10,000	....do	1876.
Do	Penobscot River, from Bangor to Hampden	1434 *bis*	1-10,000	J. A. Sullivan	1867.
Do	North shore of Penobscot Bay, from Sears Island to Sandy Point.	1329	1-10,000	C. T. Iardella	1872-73.
Do	Belfast and Searsport	1272	1-10,000	....do	1871-72.
Do	Western shore of Penobscot Bay, from Knights Point to Little River.	1288	1-10,000	F. W. Dorr	1872.
Do	North Islesboro	1257	1-10,000	A. W. Longfellow	1871.
Do	South Islesboro	1256	1-10,000	....do	1871.
Do	Islands in Penobscot Bay, south of Islesboro	1167	1-10,000	....do	1870.
Do	Western shore of Penobscot Bay, from Mount Megunticook to Knights Point.	1233	1-10,000	F. W. Dorr	1871.
Do	Western shore of Penobscot Bay, including Camden and Rockport harbors.	930	1-10,000	....do	1863.
Do	Rockland Harbor and vicinity	1160	1-10,000	W. H. Dennis	1870.
Do	Waskeag River and vicinity, Penobscot Bay	1151	1-10,000	....do	1869.
Do	Muscle Ridge Islands, entrance to Penobscot Bay	1287	1-10,000	....do	1871.
Do	The Matinicus group of islands	958	1-20,000	F. W. Dorr	1864.
Do	The Green Islands, at the mouth of Penobscot Bay	959	1-20,000	....do	1864.
Do	Western entrance to Penobscot Bay, including Monhegan, Matinic, and St. Georges Islands.	960	1-20,000	....do	1864.
Do	Seal, Tennants, and Mosquito harbors, Penobscot Bay.	1081	1-10,000	W. H. Dennis	1868.
	Penobscot Bay, to and including Kennebec River.				
Maine	St. Georges River entrance	1117	1-10,000	F. W. Dorr	1867-69.
Do	St. Georges River	1116	1-10,000	C. Hosmer	1868.
Do	Southern part of Muscongus Bay	1002	1-10,000	F. W. Dorr	1865.
Do	Islands and ledges in Muscongus Bay	1001	1-10,000	....do	1865.
Do	Friendship Island	1058	1-10,000	C. Hosmer	1866-67.
Do	Medomac River	1076	1-10,000	....do	1867-68.
Do	Muscongus Bay, from Round Pond to Hocamoe	1028	1-10,000	C. Rockwell	1866.
Do	Part of Pemmaquid Neck, including Johns Bay and Pemmaquid River.	1032	1-10,000	F. W. Dorr	1866.
Do	Pemmaquid Point, including New Harbor and the western part of Muscongus Bay	1033	1-10,000	....do	1866.
Do	Damariscotta River, upper part	994	1-10,000	S. A. Gilbert	1865.
Do	Damariscotta River	995	1-10,000	....do	1865.
Do	Linekins Bay and islands, at the mouth of Damariscotta River.	1000	1-10,000	F. W. Dorr	1865.
Do	Eastern shore of Sheepscot River and Booth Bay Harbor.	961	1-10,000	P. C. F. West	1864-65.
Do	Part of Sheepscot River	954	1-10,000	R. E. McMarth	1864.
Do	Sheepscot, Back, and Ovensmouth rivers	953	1-10,000	....do	1864.
Do	Arrowsic and Westport islands	982	1-10,000	E. Hergesheimer	1865.
Do	Sheepscot and Back rivers, containing Edgecombe and Westport islands.	801	1-10,000	H. Adams and C. Ferguson.	1858-59-60.
Do	Part of Sheepscot River and vicinity	845	1-10,000	W. H. Dennis	1859.
Do	Back River and Montseag Bay	802	1-10,000	C. Ferguson	1860.
Do	Hockomock River	842	1-10,000	H. Adams	1861-64.
Do	Georgetown Island and vicinity	889	1-10,000	C. T. Iardella	1862.
Do	Mouth of Kennebec River	588	1-10,000	H. Adams	1856.
Do	Approaches and mouth of the Kennebec River	587	1-10,000	....do	1856.
Do	Kennebec River, from Coxs Head to Indian Point	666	1-10,000	W. S. Gilbert	1857-58.
Do	Kennebec River, in vicinity of Bath, city of Bath, villages of Woolwich and Winnegance, and one of the entrances of Back River.	728	1-10,000	R. M. Bache and H. L. Whiting.	1858-59-60-90.

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	Penobscot Bay, to and including Kennebec River—Cont'd.				
Maine	Kennebec River, from Indian Point to Bath	667	1–10, 800	W. S. Gilbert	1857.
Do	Peninsula formed by the confluence of the Kennebec and Androscoggin rivers.	967	1–10, 000	R. M. Bache	1860–64.
Do	Kennebec River, from Telegraph Point to Merrymeeting Bay.	1061	1–10, 000	....do	1859–65.
Do	Western side of Merrymeeting Bay, including Androscoggin, Muddy, and Cathance rivers.	1214	1–10, 000	C. H. Boyd	1871.
Do	Kennebec River, Abagadassett Point to Richmond	1115	1–10, 000	C. H. Boyd and H. L. Whiting.	1869–90.
Do	Kennebec River, Richmond to Gardiner	1158	1–10, 000	....do	1870–90.
Do	Kennebec River, Gardiner to Augusta	1996	1–10, 000	S. Forney	1890–91.
	Kennebec River, entrance to Saco River.				
Maine	Cape Small and adjacent islands	465	1–10, 000	S. A. Gilbert, H. Adams, and C. T. Iardella.	1854–56–57.
Do	Ragged Islands and adjacent islands, near Cape Small.	466	1–10, 000	S. A. Gilbert, C. T. Iardella, and A. W. Longfellow.	1854–56–65.
Do	Mouth of New Meadow River	655	1–10, 000	C. T. Iardella	1857.
Do	A part of Sebaskahegan and Orrs islands, in Casco Bay.	1012	1–10, 000	A. W. Longfellow	1865.
Do	The heads of Casco Bay, from Middle Bay to New Meadow River.	1129	1–10, 000	....do	1867–69.
Do	New Meadow River, from Fosters Point to New Meadow Bridge.	1021	1–10, 000	J. W. Donn	1866.
Do	A part of Harpsnell Neck, with the adjacent islands in Casco Bay.	847	1–10, 000	A. W. Longfellow	1860–61.
Do	Maquoit Bay and Middle Bay, with adjacent shores of Freeport, Brunswick, and Harpsnell Neck.	923	1–10, 000	....do	1863.
Do	Halfway Rock, Casco Bay	1056	1–20, 000	C. H. Boyd	1867.
Do	Outer islands in Casco Bay	757	1–10, 000	A. W. Longfellow	1856–58.
Do	The Green Islands in Casco Bay	756	1–10, 000	....do	1856.
Do	Great Chebeag, Little Johns, and Cousins islands, and main shore to Falmouth.	919 *a*	1–10, 000	....do	1864.
Do	Additional marginal topography in Casco Bay, between Falmouth and Yarmouth.	919 *b*	1–10, 000	....do	1873.
Do	Yarmouth and Freeport entrances, with adjacent shores.	918	1–10, 000	....do	1861–62.
Do	Mouth of the Presumpscot River and islands in Casco Bay.	755	1–10, 000	....do	1855–59.
Do	Portland Harbor and environs	735	1–10, 000	....do	1854–58.
Do	Wharf and shore line, Portland Harbor	1111	1–5, 000	A. W. Longfellow and H. W. Bache.	1867.
Do	Portland City and Harbor	1140 *a*	1–1, 200	H. L. Whiting and A. Lindenkohl.	1868–69.
Do	....do	1140 *b*	1–1, 200	A. Lindenkohl	1868–69.
Do	....do	1141 *a*	1–1, 200	....do	1869.
Do	....do	1141 *b*	1–1, 200	C. Hosmer	1869.
Do	....do	1142 *a*	1–1, 200	....do	1869.
Do	....do	1142 *b*	1–1, 200	J. W. Donn	1869.
Do	....do	1143 *a*	1–1, 200	....do	1869.
Do	....do	1143 *b*	1–1, 200	C. Hosmer	1869.
Do	....do	1144 *a*	1–1, 200	J. W. Donn	1869.
Do	....do	1144 *b*	1–2, 400	J. N. McClintock	1869.
Do	Reconnoissance of Portland and vicinity	878	1–20, 000	F. W. Dorr	1862.
Do	A part of Cape Elizabeth	414	1–10, 000	A. W. Longfellow	1852.
Do	Richmonds Island Harbor and the south shore of Cape Elizabeth.	312	1–10, 000	....do	1850.
Do	Goose Fair Creek to Spurwink River	1224	1–10, 000	H. Adams	1871.
Do	North shore of Saco Bay, including Staten Island, Bluff Island, and Prouts Neck.	759	1–10, 000	A. Murray and C. Fendall.	1859.
Do	Fletchers Neck and vicinity	760	1–10, 000	C. Fendall	1859.
Do	Mouth of Saco River and Biddeford Pool from Hoyts Neck.	1188	1–10, 000	H. Adams	1870.
Do	Coast of Maine and the towns of Biddeford and Saco.	1225	1–10, 000	....do	1871.

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	Saco River to Cape Ann.				
Maine	Cape Porpoise and vicinity	761	1-10,000	C. Fendall	1859.
Do	Kennebunkport and Cape Porpoise to Hoyts Neck	1159	1-10,000	H. Adams	1870.
Do	From Ogunquit in Wells to Mousam River	1121	1-10,000	.....do	1869.
Do	Cape Neddick and Ogunquit	459	1-10,000	A. S. Wadsworth	1854.
Do	York and Cape Neddick harbors, with the intermediate coast.	440	1-10,000	A. W. Longfellow and A. S. Wadsworth.	1853.
Do	Between Kittery and York	1050	1-10,000	H. Adams	1867.
New Hampshire	Isles of Shoals	762	1-10,000	C. Fendall	1859.
Do	From Rye Harbor to near Portsmouth	1047	1-10,000	H. Adams	1867.
Do	From Great Boars Head to Rye Harbor	1023	1-10,000	.....do	1866.
Do	From East Salisbury to Hampton River	835	1-10,000	H. L. Whiting	1855.
Massachusetts	Harbor and environs of Newburyport and the mouth of the Merrimac River.	355	1-10,000	A. W. Longfellow	1851.
Do	Merrimac River from Kimballs Island to Ring Bolt Rock.	1585	1-2,400	H. Mitchel	1867.
Do	From Rowley River to Newburyport	559	1-10,000	H. Adams, H. L. Whiting.	1854.
Do	North shore of Cape Ann, including Ipswich River and vicinity.	467	1-10,000	H. L. Whiting	1853.
Do	North shore of Cape Ann, including Essex River and vicinity.	556	1-10,000	.....do	1852-55.
Do	Annisquam Harbor and vicinity, Cape Ann	396	1-10,000	H. L. Whiting and R. M. Bache.	1852.
Do	The extremity of Cape Ann, from Milk Island to Zanes Cove.	341	1-10,000	.....do	1851.
Do	Cape Ann, including Gloucester Harbor and vicinity	397	1-10,000	.....do	1851.
	Cape Ann to Cape Cod, including Boston Harbor.				
Massachusetts	North shore of Salem Harbor from Beverly Farms to Kettle Cove.	340	1-10,000	H. L. Whiting	1851.
Do	South shore of Cape Ann from Danvers New Mills to Beverly Farms.	304	1-10,000	.....do	1850.
Do	Salem Harbor, including the city and islands	303	1-10,000	.....do	1849-50.
Do	Northwest shore of Massachusetts Bay from Saugus River to Marblehead.	305	1-10,000	.....do	1849-50.
Do	Boston Harbor, The Nahants, and Tinkers Island	235	1-10,000	.....do	1847-49.
Do	Boston Harbor, from Point Shirley to Saugus River	234	1-10,000	H. L. Whiting, S. A. Gilbert, and F. W. Dorr.	1847-66.
Do	Boston Harbor, Governors and Castle islands	231	1-5,000	H. L. Whiting	1846.
Do	Boston Harbor, East Boston and part of South Boston.	230	1-5,000	.....do	1846-47.
Do	Boston Harbor, city of Boston and Charlestown	229	1-5,000	.....do	1846-47.
Do	Roxbury, Cambridge, and Medford	233 *bis*	1-10,000	.....do	1847.
Do	Boston Harbor, from Neponset River to Roxbury	232 *bis*	1-10,000	H. L. Whiting, S. A. Gilbert, and F. W. Dorr.	1847-66.
Do	Southern shore of Boston Harbor and Bay	227	1-10,000	J. B. Glück	1847.
Do	Boston Harbor, including Thompsons Island, Spectacles. Moon Head, and Squantum.	832	1-5,000	H. L. Whiting	1860.
Do	Boston Harbor, including Long Island, Deer Island, and Point Shirley.	833	1-5,000	.....do	1860.
Do	Section of Boston Harbor, including Gallops Island, Lowell Island, Georges Island, Light-House Island, and Great Brewster.	831	1-5,000	.....do	1860.
Do	Section of Boston Harbor, including the outer islands and Brewsters.	830	1-5,000	.....do	1860.
Do	Islands in Boston Harbor	238	1-10,000	J. S. Williams and H. L. Whiting.	1847-49.
Do	Section of Boston Harbor, including Rainsford Island, Petticks Island, and Nantasket.	829	1-5,000	H. L. Whiting	1860.
Do	Township of Hull	237	1-10,000	J. S. Williams	1847.
Do	Southern shore of Boston Bay	228	1-10,000	J. B. Glück	1847.
Do	Lynn Harbor and vicinity	2177	1-10,000	O. H. Tittmann	1894.
Do	Revere and vicinity	2147	1-10,000	C. T. Iardella	1893.

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	Cape Ann to Cape Cod, including Boston Harbor—Cont'd.				
Massachusetts....	Winthrop Center, Deer Island, and Beachwood, Boston Harbor.	2146	1-10,000	C. T. Iardella..............	1893.
Do............	Boston Harbor, Weymouth, North Weymouth, East Weymouth, and Hingham.	2180	1-10,000	R. M. Bache..............	1894.
Do............	Cohasset, Weir River to North Scituate Beach........	2183	1-10,000	H. G. Ogden...............	1894.
Do............	North side of Boston Bay, from Revere and Chelsea to Malden and Medford.	2190	1-10,000	W. I. Vinal................	1894.
Do............	Quincy, Neponset River to Weymouth Fore River....	2191	1-10,000	H. G. Ogden...............	1894.
Do............	Quincy Point to Montclair and Atlantic (tracing)....	2169	1-3,600	H. T. Whitman, C. E......	1894.
Do............	City of Boston and vicinity...........................	2197	1-10,000	D. B. Wainwright.........	1895.
Do............	Roxbury...	2204	1-10,000	C. H. Boyd and D. B. Wainwright.	1894.
Do............	Cohasset Harbor and westward.......................	2208	1-10,000	W. I. Vinal................	1895.
Do............	Boston Harbor, islands in............................	2155	1-10,000	R. M. Bache..............	1893.
Do............	Boston Harbor, Nantasket Beach and vicinity........	2154	1-10,000	.....do....................	1893.
Do............	Boston Harbor, Squantum to Weymouth Fore River..	2114	1-10,000	.....do....................	1892.
Do............	Boston Harbor, from bay to Nantasket Beach........	2115	1-10,000	.....do....................	1892.
Do............	Vicinity of Boston Harbor, from Cohasset Rocks to Scituate Harbor.	236 *bis*	1-10,000	H. L. Whiting............	1847.
Do............	Part of North River..................................	719	1-10,000	W. H. Dennis and A. M. Harrison.	1858.
Do............	North River (sheet No. 1)............................	1251 *a*	1-5,000	H. L. Whiting............	1870.
Do............	North River (sheet No. 2)............................	1251 *b*	1-5,000	.....do....................	1870.
Do............	Duxbury...	612	1-10,000	R. M. Bache and A. M. Harrison.	1856-57.
Do............	Plymouth Harbor....................................	425	1-10,000	S. A. Gilbert...............	1853-54.
Do............	Plymouth Harbor and vicinity........................	455	1-10,000	.....do....................	1853.
Do............	Western shore of Cape Cod Bay, from Eel River to Ship Pond.	1063	1-10,000	P. C. F. West..............	1866.
Do............	West of Cape Cod Bay (sheet No. 1)..................	2096	1-30,000	J. A. Flemer...............	1892-93.
Do............	West of Cape Cod Bay (sheet No. 2)..................	2097	1-30,000	.....do....................	1892-93.
Do............	Western shore of Cape Cod Bay, from Ship Pond to West Sandwich.	1062	1-10,000	P. C. F. West..............	1867.
Do............	Route of the proposed Cape Cod Ship Canal..........	1530	1-10,000	W. H. Dennis..............	1860.
Do............	Part of Cape Cod, from Sandy Neck, near Barnstable, to West Sandwich.	901	1-10,000	A. M. Harrison and P. C. F. West.	1860-61.
Do............	Barnstable Harbor and vicinity......................	795	1-10,000	.....do....................	1859.
Do............	North shore of Cape Cod, from North Dennis to Brewster.	1088	1-10,000	P. C. F. West..............	1868.
Do............	Southern shore of Cape Cod Bay, from Orleans to Brewster.	1078	1-10,000	H. Adams..................	1868.
Do............	Wellfleet Harbor, Cape Cod..........................	368	1-10,000	J. B. Glück................	1851.
Do............	Cape Cod, from Highland to Nauset Lights...........	260	1-10,000	H. L. Whiting and S. A. Gilbert.	1848.
Do............	Cape Cod, from Billingsgate to Pamet River.........	259	1-10,000	H. L. Whiting............	1848.
Do............	Extremity of Cape Cod, including Provincetown and part of Truro.	616	1-10,000	.....do....................	1848-57.
Do............	High Head and Old East Harbor, Cape Cod...........	1982	1-10,000	H. L. Marindin............	1889.
	Cape Cod to Narragansett Bay.				
Massachusetts....	Part of Nauset Harbor...............................	579	1-10,000	C. T. Iardella..............	1856.
Do............	Eastern shore of Cape Cod, from Pleasant Bay to Nauset Harbor.	1077	1-10,000	H. Adams..................	1868.
Do............	Shore line from Nauset Harbor southward...........	1704	1-10,000	J. B. Weir..................	1886.
Do............	Shore line in the vicinity of Chatham...............	1705	1-10,000	.....do....................	1886.
Do............	East shore of Cape Cod Bay, from Pleasant Bay to Monomoy Island.	1085 *b*	1-10,000	C. H. Boyd.................	1868.
Do............	Southern entrance of Cape Cod, including the Valley of Chatham.	1085 *a*	1-10,000	C. H. Boyd and H. L. Marindin.	1868-72.
Do............	Beaches in proximity to Chatham, Cape Cod..........	441 *bis*	1-10,000	H. L. Marindin...........	1873.
Do............	Southern extremity of Cape Cod......................	441	1-10,000	J. B. Glück................	1853.
Do............	Shore line of the northern part of Monomoy Island..	1706	1-10,000	J. B. Weir..................	1886.
Do............	Monomoy Point.......................................	1090	1-20,000	P. C. F. West..............	1868.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Cape Cod to Narragansett Bay—Continued.				
Massachuse	Monomoy Island	424	1-20,000	S. A. Gilbert and C. T. Iardella.	1853-56.
Do	Resurvey of Monomoy Point	1683	1-10,000	C. H. Boyd and C. H. Van Orden.	1886.
Do	From Bass River east	402	1-10,000	J. B. Glück	1851.
Do	A part of South Yarmouth	356	1-10,000	A. W. Longfellow	1847.
Do	Southern shore of Cape Cod, between Hyannis and Bass River.	553	1-10,000	H. L. Whiting and J. L. Sullivan.	1855.
Do	From Hyannis Point to West Yarmouth Spire	290	1-10,000	Captain Boyce	1846.
Do	East end of Nantucket, from Great Point to Siasconsett.	206	1-10,000	H. L. Whiting and W. E. Greenwell.	1846.
Do	West end of Nantucket, including Tuckernuck and Muskeget islands.	205	1-10,000	H. L. Whiting, W. E. Greenwell, and F. W. Dorr.	1856-65.
Do	Great Point and Nantucket Harbor	1818	1-10,000	E. L. Taney	1887.
Do	Nantucket Island, from Squam Head to Nebers Head, including town of Siasconsett.	1814	1-10,000	.....do	1887.
Do	Western part of Nantucket Island	1815	1-10,000	.....do	1887.
Do	Tuckernuck and Muskeget islands	1785	1-10,000	.....do	1887.
Do	South shore of Marthas Vineyard, from Nashaquitsa Cliff east.	202	1-10,000	H. L. Whiting	1846-56. 1871-86.
Do	East end of Marthas Vineyard, from Cape Page to East Chop.	204	1-10,000	.....do	1846.
Do	North shore of Marthas Vineyard, from East Chop to Menemsha Bight.	203	1-10,000	.....do	1845-46-71.
Do	Gay Head and No Mans Land	362	1-10,000	W. M. Boyce and H. L. Whiting.	1845-53.
Do	South opening into Edgartown Harbor and Cotanny Bay, including the shore line and beaches of Cotanny Bay, Skiffs Island, and the outer shore of Choppaquiddick Island.	1702	1-10,000	H. L. Whiting and W. I. Vinal.	1886-87-89.
Do	A portion of Marthas Vineyard Island	1802	1-10,000	W. I. Vinal	1888.
Do	Marthas Vineyard Island, north shore, from Choppaquonsett Pond to Menemsha Creek.	1845	1-10,000	J. W. Donn	1888.
Do	Gay Head, Marthas Vineyard Island	1844	1-2,500	.....do	1888.
Do	Marthas Vineyard Island, south shore, from Gay Head to Nashaquitsa Cliff, and north shore, from Gay Head to Menemsha Creek.	1846	1-10,000	.....do	1888.
Do	Island of No Mans Land	1856	1-5,000	.....do	1888.
Do	From Wiano Beach to Hyannisport	1999	1-10,000	D. B. Wainwright	1890.
Do	Waquoit Bay to Wiano Beach	1998	1-10,000	.....do	1890-91.
Do	From Succonesset Station to Hyannis Point	318	1-10,000	W. M. Boyce	1846.
Do	Vicinity of Succonesset Point	2039	1-10,000	D. B. Wainwright	1891.
Do	From Falmouth Spire to Succonesset Point	289	1-10,000	W. M. Boyce	1846.
Do	Falmouth to Waquoit Bay	1997	1-10,000	D. B. Wainwright	1890.
Do	Eastern Shore of Buzzards Bay	191	1-10,000	W. M. Boyce	1845.
Do	Woods Holl and vicinity	1858	1-5,000	W. I. Vinal	1888-89.
Do	Shore line of Naushon Island	1937	1-10,000	E. L. Taney	1889.
Do	The Elizabeth Island	192	1-10,000	W. M. Boyce	1845.
Do	Islands of Nashewena, Pasque, and Penikese	1938	1-10,000	E. L. Taney	1889.
Do	Cuttyhunk Island	1939	1-5,000	.....do	1889.
Do	Cuttyhunk Island and the Sow and Pigs Shoal	437	1-5,000	H. L. Whiting	1853.
Do	Vicinity of Buzzards Bay	195	1-10,000	.....do	1845.
Do	Great Hill Neck to Sconticut Neck, Buzzards Bay	196	1-10,000	.....do	1845.
Do	New Bedford and vicinity	194	1-10,000	.....do	1844.
Do	West shore of Buzzards Bay, from Mishaum Point to Clarks Cove.	193 *bis*	1-10,000	.... do	1844.
	Narragansett Bay.				
Massachusetts and Rhode Island.	From East Rock to Mishaum Point	183	1-10,000	W. M. Boyce	1844.
Rhode Island	Sakonnet Point	1161	1-10,000	C. Hosmer and H. G. Ogden.	1870.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Narragansett Bay—Continued.				
Rhode Island	From Beaver Tail Light to Sakonnet Point, or East Rock.	182	1-10,000	W. M. Boyce	1844.
Do	Sakonnet River, Black Point to Eastons Point	180	1-10,000	H. L. Whiting	1844.
Do	Eastern shore of Rhode Island, Narraganset Bay	1163	1-10,000	H. G. Ogden	1870.
Do	Part of the island of Rhode Island, including the city of Newport and vicinity.	1194	1-10,000	A. M. Harrison and C. T. Iardella.	1870-71.
Do	Part of Narragansett Bay, including Coasters Harbor Island and adjacent shores.	869	1-5,000	H. L. Whiting	1862.
Do	Coasters Harbor Island, United States Navy Training Station (lower sheet).	2080	1-600	J. A. Flemer	1891.
Do	Coasters Harbor Island, United States Navy Training Station (middle sheet).	2081	1-600	do	1891.
Do	Coasters Harbor Island, United States Navy Training Station (upper sheet).	2082	1-600	do	1891.
Do	East side of Sakonnet River	1156	1-10,000	C. Hosmer	1870.
Do	Part of the island of Rhode Island, Narragansett Bay.	1162	1-10,000	A. M. Harrison and C. T. Iardella.	1870.
Do	Part of the west shore of the island of Rhode Island, from Coddington Cove northward.	896	1-10,000	A. M. Harrison	1862.
Do	Shore line of part of west side of the island of Rhode Island from Bristol Ferry southward.	897	1-10,000	do	1861.
Do	Eastern shore of Mount Hope Bay	884	1-10,000	do	1861-65.
Massachusetts	City of Fall River and vicinity	1053	1-10,000	do	1867-70.
Do	Part of Taunton River, from Mount Hope Bay northward.	1373 *b*	1-5,000	do	1875.
Do	Part of Taunton River	1373 *a*	1-5,000	do	1874.
Do	Assonet Bay and River and part of Taunton River	1418	1-5,000	do	1875.
Do	Part of Taunton River, at Dighton	1419 *a*	1-2,500	do	1875.
Do	Part of Taunton River, from Dighton northward	1419 *b*	1-2,500	do	1875.
Do	Part of Taunton River, from Needles southward	1420 *a*	1-2,500	do	1875.
Do	Part of Taunton River, from Weir Village southward.	1420 *b*	1-2,500	do	1875.
Rhode Island	The northern shore of Mount Hope Bay	1024	1-10,000	do	1865.
Do	Detached topography near Warren	1120	1-10,000	do	1869.
Do	Bristol Neck	956	1-10,000	A. M. Harrison and C. Hosmer.	1864.
Do	Part of Providence River	913	1-10,000	A. M. Harrison, C. Hosmer, and H. G. Ogden.	1863-65.
Do	Providence Harbor	914	1-10,000	do	1865.
Do	Providence Harbor and River	1433 *a*	1-2,400	H. L. Whiting	1874.
Do	Part of Seekonk River	1433 *b*	1-2,400	do	1874.
Do	Wharf line, city of Providence	1041	1-5,000	A. M. Harrison	1867.
Do	Seekonk River	978	1-5,000	do	1865.
Do	Cowesett Bay and vicinity	912	1-10,000	do	1868.
Do	The town of East Greenwich and vicinity	1079	1-10,000	do	1868.
Do	Providence Island, Narragansett Bay	1054	1-10,000	A. M. Harrison and C. Hosmer.	1866.
Do	Conanicut, Dutch, and Gould islands, Narragansett Bay.	1119	1-10,000	A. M. Harrison and H. G. Ogden.	1869.
Do	Quonset Point to South Ferry, Narragansett Bay	911	1-10,000	do	1869.
Do	From McSparrew Hill to Point Judith	92	1-10,000	J. J. S. Hassler	1839.
Do	Coast of Rhode Island, from South Ferry to Narragansett Pier.	1118	1-10,000	A. M. Harrison and H. G. Ogden.	1869.
Do	From McSparrew Hill to Tiffs Hill (interior)	93	1-10,000	J. J. S. Hassler and O. H. Berryman.	1839.
Do	Point Judith and vicinity	1226	1-10,000	A. M. Harrison	1871.
Do	From Judith to Noyers Point	91	1-10,000	J. J. S. Hassler	1839.
Do	Part of coast of Rhode Island, from Cross Mills eastward.	1271	1-10,000	A. M. Harrison	1872.
Do	From Tiffs Hill westward (interior)	94	1-20,000	J. J. S. Hassler	1839.
Do	Block Island, New Shoreham, Newport County	90	1-10,000	do	1839.
Do	Block Island	1735	1-10,000	W. H. Dennis	1886.

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State.	Localities.	Registered number	Scale.	Topographer.	Date.
	North shore Long Island Sound.				
Rhode Island	Part of the coast of Rhode Island, from Cross Mills to West Pond.	1312	1-10,000	A. M. Harrison	1873.
Do	Joshua Champlin Fairbanks Cut to Sand Hill, southward.	129	1-20,000	J. J. S. Hassler	1840.
Do	Kingston, from Fairbanks Cut northward	128	1-10,000	....do	1840.
Connecticut	From Big Hill to North Stonington	126	1-10,000	F. H. Gerdes	1840.
Connecticut and Rhode Island.	Groton to Westerly	88	1-10,000	F. H. Gerdes and H. L. Whiting.	1839-55.
Do	North shore of Long Island Sound, Westerly and vicinity.	1736	1-10,000	W. H. Dennis	1866.
Do	Potter Hill	125	1-10,000	F. H. Gerdes	1840.
Connecticut	North Stonington and interior, from Eels Hill to Quaquotogue.	124	1-10,000	....do	1840.
Do	Milltown and interior, from North Stonington to Niantic village.	123	1-10,000	....do	1840.
Rhode Island and Connecticut.	North shore Fishers Island Sound	1734	1-10,000	W. C. Hodgkins	1882-83.
Connecticut	From Fort Hill to Mystic River	65	1-10,000	C. Renard	1838.
New York	Fishers Island	57	1-10,000	F. H. Gerdes	1838.
Do	....do	1508	1-10,000	E. Hergesheimer	1882.
Connecticut	New London and vicinity	1531	1-10,000	W. H. Dennis	1882-83.
Do	Eastern bank of Thames River	85	1-10,000	J. B. Glück	1846.
Do	Thames River, from the city of New London to Mohigan Church.	86	1-10,000	F. H. Gerdes	1839.
Do	Naval station near New London	1107	1-1,200	H. G. Ogden	1869.
Do	Interior, east of Thames River to Tantem Hill	89	1-10,000	F. H. Gerdes	1839.
Do	Thames River, from Gales Ferry to Whiptop Point	87	1-10,000	....do	1841.
Do	Thames River Naval Station to Thamesville	1359 *a*	1-10,000	H. G. Ogden and D. B. Wainwright.	1874.
Do	Thames River, vicinity of Norwich	1359 *b*	1-10,000	H. G. Ogden	1874.
Do	Western bank of Thames River	84	1-10,000	J. B. Glück	1846.
Do	From Black Point to Fort Hill, including Niantic Bay.	64	1-10,000	C. Renard	1838.
Do	Interior of the country between Thames River and Niantic River.	83	1-10,000	F. H. Gerdes	1839.
Do	North shore of Long Island Sound, from Goshen Point to Four Mile River.	1651	1-10,000	W. H. Dennis	1883-87.
Do	From Black Point to Cornfield Point	81	1-10,000	B. F. Sands	1838.
Do	From Niantic River to Lyme City	78	1-20,000	C. Preuss	1838.
Do	Mouth of Connecticut River	297	1-10,000	H. L. Whiting	1850.
Do	North shore Long Island Sound, from Four Mile River to Oyster River.	1568	1-10,000	W. C. Hodgkins and J. H. Turner.	1883-85.
Do	Connecticut River, from Lyme to Westbrook	79	1-20,000	J. J. S. Hassler	1838.
Do	Connecticut River, from Lyme to Deep River	2025	1-10,000	J. W. Donn	1890.
Do	Connecticut River, from Deep River to Salmon River.	2026	1-10,000	J. W. Donn and W. I. Vinal	1890-91.
Do	Connecticut River, from Salmon River to Whitmores Dock.	2008	1-10,000	W. C. Hodgkins	1890.
Do	Connecticut River, from Whitmores Dock to Cromwell.	2009	1-10,000	....do	1890.
Do	Connecticut River, between Middletown and Cromwell and Portland and Taylortown.	2142	1-10,000	J. W. Donn	1893.
Do	Connecticut River, Cromwell Landing to Dividend Shoal.	2044	1-10,000	W. C. Hodgkins and W. I. Vinal.	1891-92-93.
Do	Connecticut River, Rocky Hill and South Glastonbury	2045	1-10,000	W. C. Hodgkins and J. W. Donn.	1891-93.
Do	Connecticut River, Hartford and Wethersfield	2046	1-10,000	....do	1891-93.
Do	North shore of Long Island Sound, Chopmans Point to Hammonasset Point, including Westbrook and Clinton.	1551 *a*	1-10,000	W. H. Dennis	1883.
Do	Hammonasset Point to Cornfield Point	80	1-10,000	J. J. S. Hassler	1838.
Do	North shore of Long Island Sound, Hammock Point to Menunketesuck Point, including Duck Island.	1440	1-5,000	J. Hergesheimer	1877.
Do	Part of Middlesex County	130	1-20,000	T. W. Werner	1841.

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State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	North shore Long Island Sound—Continued.				
Connecticut	From New Haven to Hammonasset Point	82	1-10,000	W. M. Boyce	1838.
Do	North shore of Long Island Sound, Hammonasset Point to Guilford.	1551 *b*	1-10,000	W. H. Dennis	1884.
Do	Falkners and Goose Island, Long Island Sound	1660	1-10,000	W. H. Dennis and C. H. Van Orden.	1884.
Do	North shore of Long Island Sound, from Guilford to Johnsons Point.	1569 *a*	1-10,000	W. H. Dennis	1885.
Do	Part of New Haven County	105	1-10,000	T. W. Werner.	1840.
Do	North shore of Long Island Sound, from Johnsons Point to South End.	1569 *b*	1-10,000	W. H. Dennis	1885.
Do	Region of New Haven (sheet No. 7)	1446 *b*	1-10,000	R. M. Bache	1876-77.
Do	Region of New Haven (sheet No. 4)	1446 *a*	1-10,000	do	1875-76-77.
Do	From New Haven to Fairhaven, Catsons Rock and Whitneyville.	76	1-10,000	J. Farley	1838.
Do	Vicinity of New Haven	1605	1-10,000	R. M. Bache	1877.
Do	Region of New Haven (sheet No. 3)	1445	1-10,000	do	1871-77.
Do	Region of New Haven (sheet No. 1)	1444 *a*	1-10,000	do	1875-77.
Do	Region of New Haven (sheet No. 2)	1444 *b*	1-10,000	do	1875-77.
Do	New Haven (sheet No. 6)	1447 *a*	1-10,000	do	1877.
Do	Region of New Haven (sheet No. 5)	1447 *b*	1-10,000	do	1876-77.
Do	New Haven Harbor	1296	1-10,000	do	1872.
Do	West Haven to Black Rock	22	1-10,000	C. M. Eakin	1837.
Do	From Bridgeport to Mill River, East of New Haven (interior).	35	1-10,000	T. W. Werner	1838.
Do	Country between Milford and New Haven	1779	1-10,000	E. L. Taney	1887.
Do	do	1566	1-10,000	W. C. Hodgkins and W. I. Vinal.	1887.
Do	Between New Haven and Bridgeport	1567	1-10,000	do	1884-86-87.
Do	From Bridgeport to Frost Point, north shore of Long Island Sound.	1527	1-10,000	E. Hergesheimer	1883.
Do	Frost Point to Norwalk River and the Norwalk Islands.	1537	1-10,000	do	1884.
Do	From Black Rock to Norroton	19	1-10,000	C. M. Eakin	1835.
Do	From Westport to Bridgeport	51	1-10,000	T. A. M. Craven	1838.
Do	From Cheshire and Mount Carmel to Tashua and Merwin.	106	1-20,000	T. W. Werner	1839-40.
Do	From Tashua westward, Chestnut Hill to New Canaan.	107	1-10,000	T. A. M. Craven	1839.
Do	Between Ridgefield and Reading	131	1-20,000	H. L. Dickins	1839.
Do	Between Darien and Westport	50	1-10,000	T. A. M. Craven	1838.
Do	Norwalk River to Hollys Pond	1737	1-10,000	C. Hosmer	1885-86.
Do	Greenwich Cove and Stanford Harbor	1707	1-10,000	do	1885-86.
Connecticut and New York.	Coscob Harbor and Rye Neck	1708	1-10,000	do	1885-86.
Connecticut	Norroton Point to Milton	20	1-10,000	C. M. Eakin	1836.
Do	From Darien to Glenville and Horse Neck	49	1-10,000	T. A. M. Craven	1838.
Do	From Round Hill to New Castle	109	1-10,000	do	1839.
Do	Scovills and vicinity	108	1-10,000	do	1839.
New York and Connecticut.	From Horse Neck to Rye	48	1-10,000	do	1838.
New York	From Field west to Round Hill	110	1-10,000	do	1839.
Do	From North Castle to Hudson River at Tarrytown	111	1-10,000	do	1839.
Do	Hudson River, Greensburg, and vicinity	112	1-10,000	do	1839.
Do	From Kingsbridge to Mamaroneck	47	1-10,000	do	1837.
Do	Rye Neck to New Rochelle	1709	1-10,000	C. Hosmer	1885-86-87.
Do	Hart and City islands and vicinity	1515 *a*	1-10,000	C. Hosmer and C. T. Iardella.	1882-83-86.
Do	Rodman to Throgs Neck	46 *bis*	1-10,000	W. M. Boyce	1837.
Do	East and Harlem Rivers, from Fort Schuyler to High Bridge.	604	1-10,000	F. W. Dorr	1857-59.
	South shore of Long Island Sound.				
New York	Part of Long Island, from Napeague Harbor to Montauk Point.	62	1-10,000	C. Renard and B. F. Sands.	1838.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

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	South shore of Long Island Sound—Continued.				
New York	East end of Long Island, from Split Rock to Montauk Point.	2106	1-10,000	C. T. Iardella	1892.
Do	From Napeague to East Hampton, Long Island	60	1-10,000	C. Renard	1838.
Do	East end of Long Island, Amagansett and Acabomack Harbor eastward to Split Rock.	2053	1-10,000	C. T. Iardella	1891-92.
Do	Napeague Beach	61	1-10,000	W. M. Boyce	1845.
Do	Gardiners Island, Long Island Sound	75	1-10,000	T. A. Jenkins	1838.
Do	....do	1574 *a*	1-10,000	C. Hosmer	1882-83.
Do	Bridgehampton to Acabomack and East Hampton	74	1-10,000	T. A. Jenkins and J. B. Glück.	1838-46.
Do	Coast of Long Island, Sag Harbor, Gardiners Bay, and Three Mile Harbor.	72 *bis*	1-10,000	....do	1838-46.
Do	Shore line of the western part of Gardiners Bay, between Acabomack Harbor and Cedar Island Point, Long Island.	1570	1-10,000	C. Hosmer, W. I. Vinal, and C. T. Iardella.	1884-88.
Do	Shelter Island	69	1-10,000	T. A. Jenkins	1838.
Do	Peconic Bay, from Noyack to Sag Harbor, Long Island.	71	1-10,000	....do	1838.
Do	Shore line of the southern part of Shelter Island	1571	1-10,000	C. Hosmer, W. I. Vinal, and C. T. Iardella.	1884-88.
Do	Shore line of Shelter Island	1572	1-10,000	....do	1884-88.
Do	Plum Island and Gull Island, Long Island Sound	1574 *b*	1-10,000	C. Hosmer	1883.
Do	Plum Island and Fishers Island, Gull Island and the Dumplings.	56	1-10,000	F. H. Gerdes	1838.
Do	South shore of Long Island Sound, Oyster Pond Point to Inlet Point, including the villages of Orient and Greenport.	1577 *a*	1-10,000	C. Hosmer and W. I. Vinal.	1883-84.
Do	North shore of Long Island, Southold and Hortons Point.	1577 *b*	1-10,000	....do	1884.
Do	South Peconic Bay, from Cutchogue to Hallecks Point, Long Island.	68	1-10,000	T. A. Jenkins	1838.
Do	South shore of Little Peconic Bay, Long Island	1772	1-10,000	C. T. Iardella	1887.
Do	North shore of Great and Little Peconic bays, Long Island.	1773	1-10,000	....do	1887.
Do	South shore of Great Peconic Bay, Long Island	1774	1-10,000	....do	1887.
Do	Peconic Bay, Good Ground to Noyack, Long Island	70	1-10,000	T. A. Jenkins	1838.
Do	North shore Long Island, from Coopers Hill to Oyster Pond Point.	55	1-10,000	F. H. Gerdes	1838.
Do	North shore Long Island, from Mattituck Hills 2△ª to Goldsmiths Inlet.	1730	1-10,000	W. I. Vinal	1885.
Do	North shore Long Island, from Roanoke △ª to Mattituck Hills 2△ª.	1729	1-10,000	....do	1885.
Do	Part of Long Island, from Old Landing to Coopers Hills (on the Sound).	54	1-10,000	F. H. Gerdes	1838.
Do	Peconic Bay, River Head to Little Hog Neck, Long Island.	67	1-10,000	T. A. Jenkins	1838.
Do	West shore of Great Peconic Bay, Long Island	1775	1-10,000	C. T. Iardella	1887.
Do	Part of Long Island, from River Head to the Sound	53	1-10,000	F. H. Gerdes	1838.
Do	North shore of Long Island, from East Landing, Wading River, to Roanoke △ª.	1728	1-10,000	W. I. Vinal	1885.
Do	North shore of Long Island, from Rocky Point Landing to East Landing.	1727	1-10,000	....do	1885.
Do	Part of Long Island, north shore, from Mount Misery to Friars Head.	52	1-10,000	F. H. Gerdes	1838.
Do	Part of interior of Long Island	77	1-20,000	H. L. Dickins	1838.
Do	North shore of Long Island, from Mount Misery to Rocky Point Landing.	1726	1-10,000	W. I. Vinal	1885.
Do	Port Jefferson, Setauket, and Conscience Bay	1399	1-10,000	F. H. Gerdes	1874.
Do	Port Jefferson, north shore of Long Island	32	1-10,000	....do	1837-38.
Do	Port Jefferson to Stony Brook	1724	1-10,000	C. T. Iardella and W. I. Vinal.	1885-86.
Do	Setauket, north side of Long Island	43	1-20,000	C. Preuss	1837.
Do	Smithtown, Long Island	42	1-10,000	....do	1837.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	South Shore of Long Island Sound—Continued.				
New York	Crane Neck, north shore of Long Island	31	1-10,000	F. H. Gerdes	1837.
Do	Nissequague River, north shore of Long Island	30	1-10,000	.....do	1837.
Do	Stony Brook to Northport Beach	1723	1-10,000	C. T. Iardella	1886.
Do	Crab Meadow, north shore of Long Island	29	1-10,000	F. H. Gerdes	1837.
Do	Red Hook, Bread and Cheese Hollow, and Smithtown.	41	1-10,000	C. Preuss	1837.
Do	Red Hook, north shore of Long Island	40	1-10,000	... do	1837.
Do	Eatons Neck and adjacent shore	1732	1-10,000	W. C. Hodgkins	1885.
Do	Cow Harbor, north shore of Long Island	28	1-10,000	F. H. Gerdes	1837.
Do	Vicinity of West Hills Station, Long Island	44	1-10,000	H. L. Dickins	1836.
Do	Part of the interior of Long Island	45	1-20,000	.....do	1836-37-38.
Do	Lloyds Neck and adjacent shores	1731	1-10,000	W. C. Hodgkins	1885.
Do	From Hog Island to Eatons Neck, north shore of Long Island.	23	1-10,000	F. H. Gerdes	1836.
Do	Harbor and village of Huntington, north shore of Long Island.	24	1-10,000	A. D. Mackay and F. H. Gerdes.	1836.
Do	Oyster Bay, with shore to Mattinicock Point	1733	1-10,000	W. C. Hodgkins	1885.
Do	Cold Spring and Oyster Bay harbors, Long Island	25	1-10,000	F. H. Gerdes	1837.
Do	From Cold Spring to Glen Cove, Long Island	66	1-10,000	T. A. Jenkins	1838.
Do	Mattinicock Point, north shore of Long Island	26	1-10,000	F. H. Gerdes	1837.
Do	Buckram and vicinity, Long Island	39	1-10,000	C. Preuss	1837.
Do	Hempstead Harbor, Long Island	1722	1-10,000	C. T. Iardella	1886.
Do	Hempstead Harbor, north shore of Long Island	27	1-10,000	F. H. Gerdes	1837.
Do	Cow Neck and Manhasset, Long Island	34	1-10,000	T. W. Werner	1837.
Do	From Newlots to Jamaica and Hicksville	38	1-20,000	T. A. Jenkins	1837.
Do	Shore line of Great Neck and Manhasset Neck	1515 *b*	1-10,000	C. Hosmer and C. T. Iardella.	1883-86
Do	Great Neck, City Island, and Hart Island	33 *bis*	1-10,000	T. Werner and H. L. Whiting.	1837-50.
Do	East River, from Lawrences Point to Throgs Neck and Flushing Bay.	1725	1-10,000	E. Hergesheimer and C. T. Iardella.	1885-86.
Do	From Wards Island to Throgs Neck	488	1-10,000	F. H. Gerdes	1855.
Do	From Little Neck Bay to Flushing Bay	605	1-10,000	H. L. Whiting and C. Rockwell.	1858.
Do	Hewletts Cove, Wilkins Point, and Great Bay	14	1-10,000	C. Renard	1837.
	South shore of Long Island.				
New York	East end of Long Island, Fairfield Pond to Anegansett.	2052	1-10,000	C. T. Iardella	1891.
Do	From Good Ground to East Hampton	59	1-10,000	C. Renard	1838.
Do	East end of Long Island, Town Pond to Fairfield Pond, including Mecox Bay.	2051	1-10,000	C. T. Iardella	1891.
Do	Southampton (interior of Long Island)	73	1-10,000	T. A. Jenkins	1838.
Do	Shinnecock Bay (east end)	1928	1-10,000	C. T. Iardella	1889-90.
Do	Shinnecock Bay	1929	1-10,000	.....do	1889.
Do	Moriches Bay, from Harts Cove to Quantuck Bay	1843	1-10,000	.....do	1888.
Do	From Smiths Point to Good Ground	58	1-10,000	C. Renard	1838.
Do	Moriches Bay, from Smiths Point to Harts Cove	1842	1-10,000	C. T. Iardella	1888.
Do	From Fire Place to Center Moriches	2198	1-10,000	.....do	1894.
Do	From Roberts Dock to Patchogue, south shore of Long Island.	1402	1-10-000	.....do	1875.
Do	Between Patchogue and Smiths Point	2	1-10,000	C. Renard	1835.
Do	Fire Island Beach, from Δ^s Point Cedar to Δ^s Point Belleville.	1375 *b*	1-10,000	C. Hosmer	1874.
Do	Vicinity of Patchogue, Long Island	1374 *b*	1-10,000	.....do	1874.
Do	Fire Island Beach, from near Fire Island lighthouse, eastward to Δ^s Point Cedar.	1375 *a*	1-10,000	.....do	1873-74.
Do	Fire Island base	479	1-10,000	C. Renard	1834.
Do	Islip to Blue Point, Long Island	1374 *a*	1-10,000	C. Hosmer	1874.
Do	From Babylon to Patchogue	1	1-10,000	C. Renard	1834.
Do	West end of Fire Island beach and south shore of Long Island and vicinity of Bayshore and Islip.	1314	1-10.000	C. Hosmer	1873.
Do	Fire Island Inlet	1851	1-10,000	W. H. Dennis	1887.

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State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	South shore of Long Island—Continued.				
New York	Great South Bay and Oak Island Beach	1539*b*	1-10,000	J. W. Donn	1880.
Do	Conklins Point to Neguntatogue Creek, including Babylon.	1474	1-10,000	C. T. Iardella	1875.
Do	Eastern part of South Oyster Bay, west part of Great South Bay, Gilgoes Inlet, and east end of Jones Beach.	1539*a*	1-10,000	J. W. Donn	1880.
Do	Breslau to Ridgewood	1849	1-10,000	W. H. Dennis	1887.
Do	Between Rockaway and Fire Island Inlet	3	1-20,000	C. Renard	1835.
Do	East Hempstead and South Oyster bays	1538*b*	1-10,000	J. W. Donn	1880.
Do	Shores of Hempstead Bay, Long Island	1538*a*	1-10,000	.....do	1880.
Do	Ridgewood to Baldwin	1850	1-10,000	W. H. Dennis	1887.
Do	Hicksville and Jamaica, Brushville and Miltham	37	1-20,000	T. A. Jenkins	1837.
Do	Hempstead Bay, Far Rockaway to Luces Inlet	1471*a*	1-10,000	J. W. Donn	1879-80.
Do	Far Rockaway, Lawrence, Woodburg, and East Rockaway.	1471*b*	1-10,000	C. Junken	1879.
Do	Part of Far Rockaway, Long Island	798	1-9,880	F. W. Dorr	1860.
Do	Rockaway Inlet and Jamaica Bay	535	1-20,150	S. A. Gilbert	1855-56-59.
	New York Bay and Harbor, old surveys, 1835 to 1840.				
New York	Between the Pavilion of Rockaway and the Plum Gut.	4	1-20,000	C. Renard	1835.
Do	Fort Hamilton to Plum Gut, including Gravesend	5	1-10,000	.....do	1835.
Do	From Brooklyn to Fort Hamilton and Governors Island.	12	1-10,000	.....do	1837.
Do	From Brooklyn to Jamaica (interior)	36	1-10,000	T. A. Jenkins	1837.
Do	From Hewletts Cove to Brooklyn	13	1-10,000	C. Renard	1837.
Do	Hewletts Cove, Wilkins Point, and Great Bay	14	1-10,000	.....do	1837.
Do	Harlem River and Throgs Neck	15	1-10,000	.....do	1837.
Do	Manhattan Island, northern part of New York City to West Farms.	16	1-10,000	.....do	1837.
Do	Near Kingsbridge	113	1-10,000	T. A. M. Craven	1839.
Do	Rodman to Throgs Neck	46 *bis*	1-10,000	W. M. Boyce	1837.
Do	Coast of New York and Long Island Sound	21	1-10,000	C. M. Eakin	1837.
Do	From Kingsbridge to Mamaroneck	47	1-10,000	T. A. M. Craven	1837.
Do	Hudson River, Greensburg and vicinity	112	1-10,000	.....do	1839.
New York and New Jersey.	West side of Hudson River, from Boompers Hook north as far as Croton Point and west to Goffle Mountain.	132	1-20,000	H. L. Dickins	1840.
New York	From Fort Lee to Boompers Hook	96	1-10,000	T. A. Jenkins	1839.
New Jersey	From North Scralenburg to Passaic River	97	1-10,000	.....do	1839.
Do	From Hackensack to Patterson	98	1-10,000	.....do	1839.
Do	Between Hackensack and Bergen	17	1-10,000	C. Renard	1837.
Do	From Patterson to Weasel	99	1-10,000	T. A. Jenkins	1839.
Do	Belleville	101	1-10,000	.....do	1839.
Do	From Hackensack to Newark and Elizabethtown	100	1-10,000	.....do	1839.
Do	From Weasel Mountain to Springfield	102	1-10,000	.....do	1839.
Do	From Jersey Point to Constables Point	18	1-10,000	C. Renard	1837.
Do	From Elizabethtown to Newark	10	1-10,000	C. Renard and T. A. Jenkins.	1836.
New York	Tompkinsville, Staten Island	6	1-5,000	C. Renard	1835.
Do	Staten Island	9	1-10,000	.....do	1835-36.
New Jersey	From Perth Amboy to Elizabethtown	8	1-10,000	.....do	1836.
Do	Rahway	104	1-10,000	T. A. Jenkins	1839.
Do	Springfield	103	1-10,000	.....do	1839.
Do	South Rahway (interior)	133	1-10,000	T. A. M. Craven	1840.
Do	Woodbridge to New Market (interior)	134	1-10,000	.....do	1840.
Do	Bound Brook (interior)	135	1-10,000	.....do	1840.
Do	New Brunswick and vicinity	136	1-10,000	.....do	1840.
Do	Sand Hills and vicinity	137	1-20,000	.....do	1839-40.
Do	Valley of the Raritan, from Perth Amboy to New Brunswick.	11	1-10,000	C. Renard	1836.
New York	From the Highlands of Navesink to South Amboy, north shore of New Jersey.	7	1-10,000	.....do	1836.
New Jersey	From Eatontown to Lawrences Brook	122	1-20,000	B. F. Sands	1840.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	New York Bay and Harbor, old surveys, 1885 to 1840—Continued.				
New Jersey	Sandy Hook	239	1-10,000	C. Renard	1836.
Do	From Navesink to Poplar Creek	114	1-10,000	B. F. Sands	1839.
Do	Portions of Middlesex and Monmouth counties	145	1-20,000	H. L. Dickins	1841.
New York and New Jersey.	New York Harbor, from Sandy Hook to New York City and northward.	1947	1-30,000	C. M. Eakin	1843-44.
Do	New York Harbor, from Highlands of Navesink to Jersey City and northward, including Staten Island.	1946	1-30,000	do	1843-44.
	New York Harbor surveys, 1848 to 1875.				
New York	Rockaway Inlet and Jamaica Bay	535	1-20,150	S. A. Gilbert, J. A. Sullivan, W. S. Gilbert, and F. W. Dorr.	1855-56-59.
Do	Coney Island and Dead Horse Inlet	586	1-10,000	S. A. Gilbert and J. A. Sullivan.	1855-56.
Do	From Gowanus Bay to Bath, western end of Long Island.	487	1-10,000	S. A. Gilbert	1855-56.
Do	Gowanus Bay and vicinity, Long Island	599	1-10,000	S. A. Gilbert and J. A. Sullivan.	1857.
Do	do	597	1-10,000	S. A. Gilbert	1856.
Do	do	598	1-10,000	S. A. Gilbert and W. S. Gilbert.	1856.
Do	East River, from Brooklyn to Hell Gate	483	1-10,000	F. H. Gerdes	1855.
Do	Brooklyn and vicinity	917	1-10,000	do	1856-63.
Do	Part of Brooklyn, including Williamsburg and Green Point.	789	1-10,000	F. W. Dorr	1859-60.
Do	Interior of Long Island, between Brooklyn, Flushing, and Jamaica.	924	1-10,000	H. L. Whiting and J. W. Donn.	1862.
Do	From Flushing Bay to Hunters Point	808	1-10,000	H. L. Whiting	1856.
Do	From Little Neck Bay to Flushing Bay	605	1-10,000	H. L. Whiting and C. Rockwell.	1858.
Do	Hell Gate and vicinity	258	1-5,000	H. L. Whiting	1848.
Do	Wards, Randalls, North and South Brother, and Rikers islands.	675	1-5,000	H. L. Whiting and C. Rockwell.	1857.
Do	From Wards Island to Throgs Neck	488	1-10,000	F. H. Gerdes	1855.
Do	East and Harlem rivers, from Fort Schuyler to High Bridge.	604	1-10,000	F. W. Dorr	1857-59.
Do	Cities of New York and Brooklyn	608	1-10,000	A. Boschke	1855-57.
Do	Manhattan Island	475	1-10,000	F. H. Gerdes	1854-55-63.
Do	Upper part of Manhattan Island	658 *a*	1-10,000	J. Mechan	1857.
Do	A compilation of shore line of Harlem River and Spuyten Duyvil Creek, with adjacent topography.	658 *b*	1-10,000	do	1855-59.
Do	From High Bridge to Kings Bridge, east side of Harlem River.	775	1-10,000	F. W. Dorr and C. Rockwell.	1859.
Do	Hudson River, from Spuyten Duyvil to Yonkers	810	1-10,000	H. L. Whiting and C. Rockwell.	1859.
Do	Hudson River, from Spuyten Duyvil Creek to Sounding Point.	419	1-10,000	F. H. Gerdes	1853.
Do	Hudson River, from Jeffreys Hook to Spuyten Duyvil Creek.	418	1-10,000	do	1853.
Do	West shore of Hudson River, from Fort Lee north and south.	609	1-10,000	H. L. Whiting and C. Rockwell.	1857.
New York and New Jersey.	From Guttenberg to Tabby Hook	485	1-10,000	F. H. Gerdes	1856.
New Jersey	Resurvey of west shore of Hudson River from Guttenberg to Bulls Ferry.	610 *c*	1-10,000	H. L. Whiting and R. B. Palfrey.	1875.
New York and New Jersey.	Hudson River, Jersey City to Guttenberg	484	1-10,000	F. H. Gerdes	1855-56.
New Jersey	Resurvey of Hoboken and Jersey City wharf line from Guttenberg to New Jersey Central Railroad pier.	610 *b*	1-10,000	H. L. Whiting, W. M. De Wees, and R. B. Palfrey.	1873-75.
Do	West line of Hudson River, from Jersey City to Guttenberg.	610 *a*	1-10,000	H. L. Whiting, F. W. Dorr, and C. Rockwill.	1857-59.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	New York Harbor surveys, 1848 to 1875—Continued.				
New Jersey	Jersey City to Caven Point	482	1-10,000	A. S. Wadsworth	1855.
New York	Governors, Bedloes, and Ellis islands, New York Harbor.	677	1-5,000	J. Mechan	1857.
Do	Bedloes and Ellis islands	543	1-10,000	F. H. Gerdes	1855.
New Jersey	New York Harbor, Bergen Neck	662	1-10,000	J. Mechan and H. L. Whiting.	1857-75.
New York	New York Harbor, Caven Point to Kill van Kull	489	1-10,000	A. S. Wadsworth	1855.
New Jersey	Bergen Neck, from Centerville to New Jersey Railroad.	733	1-10,000	F. W. Dorr	1858.
New York	Passaic River and Newark Neck	734	1-10,000	.....do	1858.
New York and New Jersey.	Newark Bay and part of Kill van Kull	533	1-10,000	A. S. Wadsworth	1855.
New York	From New Brighton to Great Kills, Staten Island	490	1-10,000	.....do	1855.
Do	Staten Island, New York Harbor, from New Brighton to Fresh Kills.	816	1-10,000	F. W. Dorr and C. M. Bache.	1856-65.
New York and New Jersey.	Northeastern part of Staten Island and Bergen Point, including resurvey of wharf lines through Kill van Kull.	751	1-10,000	H. L. Whiting and R. B. Palfrey.	1857-75.
New York	Staten Island, from Wards Point to Great Kills	680	1-10,000	H. L. Whiting and F. W. Dorr.	1856.
Do	.....do	680 *bis*	1-10,000	.....do	1856.
Do	From Great Kills to Wards Point, Staten Island	532	1-10,000	A. S. Wadsworth	1855.
New Jersey	Elizabethport to Rahway Creek	530	1-10,000	.....do	1855.
Do	The western shore of Newark Bay and Staten Island Sound, from the mouth of Passaic River to Perth Amboy.	729	1-10,000	F. W. Dorr	1858.
Do	Staten Island Sound, Rahway Creek to Woodbridge Landing.	531	1-10,000	A. S. Wadsworth	1855.
Do	Staten Island Sound, Perth Amboy to Woodbridge Landing.	534	1-10,000	H. Adams	1855.
Do	From South Amboy to Keyport	542	1-10,000	A. M. Harrison and P. R. Hawley.	1855-56.
Do	From Point Comfort eastward, coast of New Jersey	541	1-10,000	A. M. Harrison and W. H. Dennis.	1855-56.
Do	Shore of Sandy Hook and vicinity	486	1-10,000	A. M. Harrison	1855.
Do	Sandy Hook Island	252	1-20,000	S. A. Gilbert	1848.
Do	Sandy Hook	278	1-20,000	H. L. Whiting	1850.
Do	The shore of Sandy Hook, from the Ocean House northward.	342	1-10,000	R. M. Bache	1851.
Do	Shore line of Sandy Hook	413	1-10,000	F. H. Gerdes	1853.
Do	Resurvey of Sandy Hook	894	1-5,000	H. L. Whiting and F. P. Webber.	1862.
	Surveys of New York Bay and Harbor, between 1875 and 1892.				
New York	Eastern part of Jamaica Bay, from Big Mucks Creek to head of bay.	1482 *b*	1-10,000	J. W. Donn	1878.
Do	Rockaway Beach and middle part of Jamaica Bay	1482 *a*	1-10,000	.....do	1878.
Do	Rockaway Beach, Long Island	1593	1-10,000	J. Hergesheimer	1885.
Do	Rockaway Beach and Barren Island, Long Island	1594	1-5,000	.....do	1885.
Do	West end of Rockaway Beach, Barren Island, and entrance of Dead Horse Inlet, showing changes in Rockaway Inlet since survey of 1856.	1449	1-5,000	J. W. Donn	1877.
Do	Jamaica Bay, western part, from Barren Island to Canarsie Point.	1448 *a*	1-5,000	.....do	1877.
Do	Jamaica Bay, northwest portion, including Canarsie Bay.	1448 *b*	1-5,000	.....do	1877.
Do	Coney Island, Sheepshead Bay, and Gravesend Bay	1456	1-5,000	.....do	1878.
Do	Coney Island	1592	1-5,000	J. Hergesheimer	1885.
Do	Resurvey of the wharf and shore line of the Narrows of New York Harbor.	1413 *a*	1-10,000	H. L. Whiting	1875.

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	Surveys of New York Bay and Harbor, between 1875 and 1892—Continued.				
New York	Shore line of Long and Staten islands from Red Hook to Unionville, and from North Shore to Fort Tompkins.	1576	1-10,000	D. B. Wainwright	1885.
Do	Resurvey of wharf and shore line, East River and Brooklyn front from Bay Ridge to Astoria.	1414	1-10,000	H. L. Whiting	1875.
Do	East River front of New York and Brooklyn, from Red Hook Battery to Blackwells Island.	1586	1-10,000	E. Hergesheimer	1885.
Do	Blackwells, Wards, and Randalls islands and adjacent shores of East and Harlem Rivers from Fifty-first street, New York City, to Lawrences Point.	1668	1-5,000	do	1885.
Do	Harlem River, from Randalls Island to High Bridge	1703	1-5,000	D. B. Wainwright	1886.
Do	Harlem River, from High Bridge to Spuyten Duyvil Creek.	1742	1, 5,000	do	1886.
Do	Hudson River, from Eightieth street to Spuyten Duyvil Creek.	1743	1-10,000	do	1886.
Do	Shore line and dock line, Hudson River, Fifteenth street to Sixty-third street and opposite shore.	1573	1-5,000	do	1885.
Do	Shore line of the Hudson River, from the Battery to Fifteenth street and opposite shore.	1578	1-5,000	do	1885.
Do	Shore line Cavens Point to New Jersey Central Railroad docks.	1575	1-5,000	do	1885.
Do	Ellis Island	2098	1-2,500	W. P. Ritter	1892.
New York and New Jersey.	Kill van Kull and east shore of Bergen Neck	1579	1-10,000	E. L. Taney	1885.
Do	Newark Bay and mouths of Passaic and Hackensack rivers.	1719	1-10,000	do	1885-86.
New Jersey	Hackensack and Passaic rivers and vicinity	1398 *a*	1-10,000	F. H. Gerdes	1871-74.
Do	Hackensack River, from Erie Railroad Bridge to the town of Hackensack.	1398 *b*	1-10,000	do	1872-73-74.
Do	English Creek, from Little Ferry, on Hackensack River, to the head of navigation.	1398 *c*	1-10,000	do	1873-74.
New York	East shore of Staten Island, from the Narrows to Great Kill.	1710	1-10,000	R. M. Bache	1886.
Do	Quarantine piers, New York Bay	1413 *b*	1-10,000	H. L. Whiting	1875.
Do	Southern shore of Staten Island, from Great Kill to Princess Bay.	1711	1-10,000	R. M. Bache	1886.
New York and New Jersey.	Head of Raritan Bay, including the mouths of Raritan River and Arthur Kill.	1712	1-10,000	do	1886.
Do	Shores of Arthur Kill, from Elizabethport to Rossville.	1720	1-10,000	E. L. Taney	1886.
New Jersey	Raritan River, from Crab Island to New Brunswick	1354 *a*	1-5,000	F. H. Gerdes	1873.
Do	South River (a branch of the Raritan), from Brisset's brickyard to mouth.	1354 *b*	1-5,000	do	1873.
Do	From Keyport to Port Monmouth	1713	1-10,000	D. B. Wainwright	1886.
Do	Port Monmouth to Sandy Hook	1721	1-10,000	do	1886.
Do	North part of Sandy Hook	1580	1-5,000	E. L. Taney	1885.
Do	From Highlands of Navesink to Shrewsbury River	1005	1-10,000	C. M. Bache	1864-65.
	Hudson River.				
New York and New Jersey.	From Guttenberg to Tabby Hook	485	1-10,000	F. H. Gerdes	1855-56.
New York	Hudson River, from Jeffreys Hook to Spuyten Duyvil Creek.	418	1-10,000	do	1853.
Do	Hudson River, from Spuyten Duyvil Creek to Sounding Point.	419	1-10,000	do	1853.
New York and New Jersey.	Hudson River, from Spuyten Duyvil Creek to Yonkers.	810	1-10,000	H. L. Whiting and C. Rockwell.	1859.
Do	Hudson River, from Yonkers up	811	1-10,000	do	1859.
Do	Hudson River, near Piermont	800	1-10,000	J. Mechan	1860.
New York	Hudson River, Hastings to Tarrytown	420	1-10,000	F. H. Gerdes	1853.
Do	From North Castle to Hudson River at Tarrytown	111	1-10,000	T. A. M. Craven	1839.
Do	Tappan Bay, Hudson River	770	1-10,000	J. Mechan	1859.

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State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Hudson River—Continued.				
New York	Hudson River, from Tarrytown to Croton Point	421	1–10,000	F. H. Gerdes	1853.
Do	East shore of Hudson, from near Tarrytown to Croton.	968	1–10,000	H. L. Whiting and J. W. Donn.	1862–64.
Do	Hudson River, from Sing Sing to Stony Point	468	1–10,000	F. H. Gerdes	1854.
New York and Connecticut.	Hudson River, from Croton Point to Bakers Hill and Bald Hill.	95	1–20,000	H. L. Dickins	1839–40.
New York	West side of Hudson River, from Hook Mountain to Haverstraw.	969	1–10,000	C. Rockwell and H. L. Whiting.	1864.
Do	West shore of Hudson River, from Haverstraw to Tompkins Cove.	1514	1–10,000	W. I. Vinal	1881.
Do	East side of Hudson River, from Croton to Peekskill.	1472	1–10,000	H. L. Whiting	1877–78.
Do	Hudson River, from Crugers to Peekskill	480	1–10,000	F. H. Gerdes	1854.
Do	Hudson River, Tompkins Cove to Highland Falls	2084	1–10,000	J. W. Donn	1891.
Do	East shore of Hudson River, Peekskill to Constitution Island.	1516 *a*	1–10,000	H. L. Whiting and W. C. Hodgkins.	1878.
Do	Anthonys Nose to West Point	1010	1–10,000	J. Mechan	1861.
Do	Hudson River, vicinity of West Point	1623	1–10,000	H. L. Whiting	1881.
Do	Reservation for United States Military Academy at West Point.	1504	1–4,800	.....do	1880.
Do	East shore of Hudson River, Constitution Island to Rocky Bluff.	1516 *b*	1–10,000	.....do	1879.
Do	Hudson River, Crows Nest Mountain to Cornwall	2083	1–10,000	J. W. Donn	1891.
Do	Shore line of Hudson River, Cold Spring to Shermans Dock.	1011	1–10,000	F. Mechan	1861.
Do	Hudson River, from Moodna Creek to Newburg and Fishkill Ferry.	2119	1–10,000	J. W. Donn	1892.
Do	Newburg and Fishkill to Roseton and Low Point, Hudson River.	2181	1–10,000	.....do	1894.
Do	Reconnoissance of Rondout Creek	727	1–5,000	E. Blunt	1858.
Do	Town and harbor of Rondout and vicinity	1533 *a*	1–2,500	F. H. Gerdes	1868.
Do	South Rondout westward	1533 *b*	1–2,500	.....do	1868.
Do	Esopus Creek, Ulster County	726	1–5,000	C. Fendall	1858.
Do	Hudson River, Normans Kill to Albany	593	1–5,000	A. S. Wadsworth	1856.
Do	Hudson River, △ⁿ Point Welch to △ⁿ Point Dow	594	1–5,000	.....do	1856.
Do	Hudson River, Cow Island to Bear Island	595	1–5,000	.....do	1856.
Do	Hudson River, △ⁿ Point Ten Eyke to △ⁿ Point Castleton.	596	1–5,000	.....do	1856.
Do	Hudson River, New Baltimore to Coeymans	692	1–5,000	A. Strauss	1856.
	Lake Champlain.				
New York and Vermont.	Lake Champlain, Whitehall to Cold Spring, including South Bay.	1361	1–10,000	Andrew Braid	1874.
Do	Lake Champlain, from below Chipmans Point to Pulpit Point.	1361 *a*	1–10,000	.....do	1874.
Do	Lake Champlain, from Larabel Landing to Chipmans Point, including Fort Ticonderoga.	1360 *b*	1–10,000	.....do	1874.
New York	Lake Champlain, Fort Ticonderoga and vicinity	1360 *c*	1–2,500	.....do	1874.
New York and Vermont.	Lake Champlain, from Plumies Point southward, including town of Crown Point.	1360 *a*	1–10,000	.....do	1874.
Do	Lake Champlain, Elm Point to Crown Point	1368 *b*	1–10,000	C. T. Iardella and H. W. Bache.	1874.
New York	Lake Champlain, fortifications at Crown Point	1368 *c*	1–2,500	C. T. Iardella	1874.
New York and Vermont.	Lake Champlain, Potash Point to Northwest and Button bays.	1368 *a*	1–10,000	C. T. Iardella and H. W. Bache.	1874.
Do	Lake Champlain, Scotch Bonnet to Split Rock Point	1367 *b*	1–10,000	.....do	1874.
Do	Lake Champlain, Split Rock Point to Essex	1367 *a*	1–10,000	.....do	1874.
Do	Lake Champlain, Saxtons Point to Hills Point	1366 *a*	1–10,000	.....do	1874.
Vermont	Lake Champlain, Shelburne Bay and vicinity	1394	1–10,000	H. G. Ogden and Andrew Braid.	1873.
Do	Lake Champlain, Shelburne Point to Apple Tree Point.	1181 *a*	1–10,000	F. W. Dorr	1870.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Lake Champlain—Continued.				
Vermont	Lake Champlain, city of Burlington and vicinity	1181 *b*	1-10,000	H. G. Ogden and Andrew Braid.	1872.
Do	Lake Champlain, from Apple Tree Point to Hogs Back Island.	1182	1-10,000	F. W. Dorr	1870.
Do	Malletts Bay and vicinity	1205	1-10,000	C. Hosmer	1871.
Do	Lake Champlain, southeastern part of Grand Island	1186	1-10,000	do	1871.
Do	Lake Champlain, Sand Bar Bridge to Savage Island	1206	1-10,000	do	1871.
Do	Lake Champlain and vicinity, Knights Island and Ladds Point.	1207	1-10,000	do	1871.
Do	Lake Champlain, St. Albans and Lapans bays, including Potters and Woods islands.	1208	1-10,000	do	1871.
Do	Lake Champlain, Butlers Island northward to McQuam Bay.	1209	1-10,000	do	1871.
Do	Lake Champlain, Missisquoi Bay (lower part)	1222	1-10,000	H. G. Ogden and Andrew Braid.	1871.
Vermont and Canada.	Lake Champlain, Missisquoi Bay, from the boundary line southward.	1223	1-10,000	do	1871.
Vermont	Lake Champlain, La Motte and Alburg passages	1220	1-10,000	do	1871.
New York and Vermont.	Lake Champlain, Isle La Motte to the boundary line.	1221	1-10,000	do	1871.
Do	Lake Champlain, Point au Roche to Long and Sandy points.	1219	1-10,000	do	1871.
Do	Lake Champlain, from the Gut to Point au Roche	1218	1-10,000	do	1871.
Do	Lake Champlain, Treadwells Bay and vicinity	1217	1-10,000	do	1871.
New York	Plattsburg and vicinity	1184 *a*	1-10,000	do	1872.
Do	Cumberland Head to Valcours Island	1184 *b*	1-10,000	C. Hosmer	1870.
Do	Bluff Point to Port Kent, including Valcours Island	1320	1-10,000	H. G. Ogden and Andrew Braid.	1873.
Do	Lake Champlain, from Trembleau Point to Port Jackson.	1183	1-10,000	F. W. Dorr	1870.
Do	Lake Champlain, Port Kent to Jones Point	1319 *a*	1-10,000	H. G. Ogden and Andrew Braid.	1873.
Do	Lake Champlain, southwestern shore of Willsboro Bay.	1319 *b*	1-10,000	H. G. Ogden	1873.
Do	Lake Champlain, Trembleau Point to Ligonier Point.	1185	1-10,000	F. W. Dorr and C. Hosmer.	1870.
New York and Vermont.	Lake Champlain, Saxtons Point to Hills Point	1366 *a*	1-10,000	C. T. Iardella and H. W. Bache.	1874.
	Coast of New Jersey.				
New Jersey	From Navesink to Poplar Creek	114	1-10,000	B. F. Sands	1839.
Do	From Eatontown to Lawrences Brook	122	1-20,000	do	1840.
Do	From Highlands of Navesink to Shrewsbury River	1005	1-10,000	C. M. Bache	1864-65.
Do	Long Branch and vicinity	1022	1-10,000	do	1866.
Do	From Poplar Creek to Manasquan River	115	1-10,000	B. F. Sands	1839.
Do	Portions of Middlesex and Monmouth counties	145	1-20,000	H. L. Dickins	1841.
Do	From Deal to Squam Village	1083	1-10,000	C. M. Bache	1867.
Do	From Squam Village to head of Barnegat Bay	1084	1-10,000	do	1868.
Do	Manasquan to Metedeconk River	116	1-10,000	B. F. Sands	1839.
Do	From Tillers Tavern to Blue Ball (interior)	158	1-20,000	H. L. Dickins	1842.
Do	From Toms River northward	1407	1-20,000	C. M. Bache	1875.
Do	From Metedeconk to Cedar Creek	117	1-10,000	B. F. Sands	1839.
Do	Vicinity of Manchester and Toms River (interior)	159	1-20,000	H. L. Dickins	1842.
Do	From Barnegat to Toms River	1371	1-20,000	C. M. Bache	1874.
Do	From Metedeconk River to Barnegat	120	1-20,000	C. Renard	1839.
Do	From Cedar Creek to Barnegat	118	1-10,000	B. F. Sands	1839.
Do	Farrago Forge to Barnegat (interior)	160	1-20,000	H. L. Dickins	1842.
Do	Barnegat Inlet	1015	1-10,000	C. Fendall	1866.
Do	From Barnegat Inlet to Flat Island	121	1-20,000	C. Renard	1839.
Do	From Barnegat Bay to Little Egg Harbor	119	1-20,000	B. F. Sands	1840-41.
Do	Manahawken to Barnegat	1315 *b*	1-20,000	C. M. Bache and H. W. Bache.	1873.
Do	Tuckerton and Manahawken	1315 *a*	1-20,000	do	1873.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Coast of New Jersey—Continued.				
New Jersey	Little Egg Harbor and part of Mullica River	1333	1-20,000	C. M. Bache	1871.
Do	Mullica River, from Port Republic to Green Brook	1318	1-10,000	H. M. De Wees	1873.
Do	From Little Egg Harbor to Bakersville	142	1-20,000	B. F. Sands	1841.
Do	Vicinity of Absecon Inlet	1166	1-20,000	C. M. Bache and H. W. Bache.	1869-70.
Do	Absecon Inlet	952	1-10,000	H. W. Bache	1863-64.
Do	Great Egg Harbor Bay and shore line, from Absecon Inlet southward to Pecks Beach L. S. S.	2054	1-20,000	E. E. Haskell	1891.
Do	From Bakersville to Great Egg Harbor Bay	143	1-10,000	B. F. Sands	1841.
Do	Great Egg Harbor Bay	146	1-10,000	.....do	1842.
New York	Above and below Great Egg Harbor	1744	1-20,000	C. M. Bache	1886.
New Jersey	From Great Egg Harbor to Hereford	147	1-10,000	B. F. Sands	1842.
Do	Southwestward from Corsons Inlet	1597	1-20,000	C. M. Bache	1883-85.
Do	Hereford Inlet, northward	1532	1-10,000	.....do	1881.
Do	From Cold Spring Inlet to Hereford Inlet	1483	1-10,000	.....do	1880.
Do	From Cape May Court-House to Cold Spring	154	1-10,000	F. H. Gerdes	1842.
Do	From Hereford Inlet to Cape May Light-house	148	1-10,000	G. D. Wise	1842.
Do	Cape May City and vicinity	1470	1-10,000	C. M. Bache	1879.
	Delaware Bay and River.				
New Jersey	The peninsula of Cape May	149	1-10,000	G. D. Wise	1842.
Do	From Mareys Landing to Dennis Creek	153	1-10,000	F. H. Gerdes	1842.
Do	From near the Hummocks to New England Creek	1549 *a*	1-20,000	R. M. Bache	1883.
Do	From the Hummocks to Egg Island Light-House	1549 *b*	1-20,000	R. M. Bache and E. L. Taney.	1883-84.
Do	From Cohansey to Dennis Creek	157	1-20,000	H. L. Whiting	1842.
Do	From Cohansey to West Creek, Delaware Bay	152	1-20,000	F. H. Gerdes	1842.
Do	From Egg Island Light to Sea Breeze Beach	1661	1-20,000	R. M. Bache and E. L. Taney.	1884-85.
New Jersey and Delaware.	From Stony Point to Ben Davis Point	63	1-20,000	F. H. Gerdes	1841.
Do	.....do	141	1-10,000	.....do	1841.
New Jersey	From Salem Creek to Cohansey Creek	155	1-20,000	H. L. Whiting	1842-43.
Do	From Jacobs Creek to Sea Breeze	1565	1-20,000	R. M. Bache	1885.
Do	From Elsingboro Point to below Jacobs Creek	1550	1-20,000	.....do	1882-83.
New Jersey and Delaware.	From Listons Point to Pea Patch Island	140	1-10,000	F. H. Gerdes	1841.
Do	From Wilmington to Pea Patch Island	138	1-10,000	.....do	1841.
New Jersey	From Kellys Point to Elsingboro Point	1505 *b*	1-10,000	R. M. Bache	1882.
Do	From Deep Water Point to Kellys Point	1505 *a*	1-5,000	.....do	1881-82.
Do	From Salem Creek to Penns Grove	156	1-10,000	H. L. Whiting	1843.
Delaware	From Wilmington to Newcastle	139	1-10,000	F. H. Gerdes	1839.
Do	North of Wilmington (interior)	162	1-20,000	J. J. S. Hassler	1846.
Delaware and Maryland.	From Wilmington to Maryland boundary (interior)	169	1-20,000	T. W. Werner	1843.
Do	From Ash Signal to Riggs Hill, including head of Elk River (interior).	170	1-20,000	.... do	1843.
New Jersey	Penns Grove to Raccoon Creek	163	1-10,000	J. J. S. Hassler	1846.
New Jersey and Pennsylvania.	From Penns Grove to Lazaretto	161	1-10,000	W. M. Boyce	1841-42.
Do	From Lazaretto to mouth of Schuylkill River	164	1-10,000	.....do	1842.
Do	Vicinity of Philadelphia	165	1-10,000	.....do	1842.
Do	From Philadelphia and Camden north	168	1-10,000	J. J. S. Hassler	1843-44.
Do	From Torresdale to Burlington and Bristol	167	1-10,000	.....do	1843-44.
Do	From Bristol to Morrisville	171	1-10,000	.....do	1843-44.
Do	From Newbolds Island to White Hill	173	1-10,000	.....do	1843-44.
Pennsylvania and New Jersey.	From Bordentown to Trenton	172	1-10,000	G. D. Wise	1844.
Do	From Trenton to Newtown and Hopewell	144	1-20,000	T. A. M. Craven	1841.
New Jersey	Princeton and vicinity	127	1-20,000	F. H. Gerdes	1840.
Do	From near South Penns Grove to Deep Water Point	1509 *b*	1-5,000	R. M. Bache	1881.
Do	From Penns Grove toward Deep Water Point	1509 *a*	1-5,000	.....do	1881.

List of orignal topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Delaware Bay and River—Continued.				
New Jersey	From Old Mans Creek to the outskirts of Penns Grove.	1545	1-5,000	R. M. Bache	1881.
Do	From Old Mans Creek to Raccoon Creek	1615	1-5,000	....do	1881.
Pennsylvania and New Jersey.	From Simpsons Wharf to Chester	1485	1-5,000	C. T. Iardella	1880-81.
Do	From △ª Station Powder Magazine to Simpsons Wharf.	1484 *b*	1-5,000	....do	1880.
Do	From Fort Mifflin to △ª Station Powder Magazine	1484 *a*	1-5,000	....do	1880.
Do	League Island and mouth of Schuylkill River	1991	1-9,600	R. M. Bache	1890.
Do	Philadelphia, Greenwich Point to Fort Mifflin	2100	1-2,400	....do	1891.
Do	Eastern part of League Island, showing condition of Old Back Channel.	1582	1-3,000	G. Davidson	1863.
Do	....do	1583	1-3,000	....do	1863.
Do	Shore line, Delaware River, from Kaighns Point to Howells Cove.	1945	1-4,800	R. M. Bache	1878-79.
Pennsylvania	Shore line, Delaware River, from site of navy-yard to League Island and mouth of Schuylkill River.	1944	1-4,800	....do	1878-79.
Do	Water front of Philadelphia, from Tasker street to Pollock street.	1986	1-1,200	....do	1889.
Pennsylvania and New Jersey.	Delaware River, from Bridesburg to Fort Mifflin	1992	1-9,600	....do	1890.
Pennsylvania	Water front of Philadelphia, from Market street to Tasker street.	1985	1-1,200	....do	1889.
Do	Water front of Philadelphia, from Dickinson street to Poplar street.	1957	1-4,800	....do	1878.
Pennsylvania and New Jersey.	Shore line, Delaware River, from Reading Railroad coal wharves to site of navy-yard.	1943	1-4,800	....do	1878-79
Do	Coopers Point and Pettys Island	1956	1-4,800	....do	1878.
Pennsylvania	Water front of Philadelphia, from Susquehanna avenue to Market street.	1902	1-1,200	....do	1888-89
Do	Philadelphia water front, from Erie avenue to Susquehanna avenue.	2099	1-1,200	....do	1890.
Pennsylvania and New Jersey.	Shore line, Delaware River, Bridesburg to Reading Railroad coal wharves.	1942	1-4,800	....do	1878-79.
Do	Port Richmond to Ten Mile Point	1993	1-9,600	....do	1890.
Pennsylvania	Water front of Philadelphia, from Bridge street to Erie avenue.	1934	1-1,200	....do	1888.
Pennsylvania and New Jersey.	Delaware River, Bridesburg Wharf, and Pensauken Creek to Poquessing Creek and Delanco (five tracings).	2144	1-2,400	Survey department of Philadelphia.	1885.
Pennsylvania	League Island Channel and vicinity	975	1-2,500	R. M. Bache	1865.
Do	Stakes in the Gut east of the bridge, League Island	975 *bis*	1-2,500	....do	1865.
Do	Schuylkill River, from Grays Ferry to Girard Point	1853	1-7,600	J. Hergesheimer	1888.
Do	Schuylkill River, from League Island to Grays Ferry Bridge.	1927	1-4,800	....do	1889.
Do	Schuylkill River, Philadelphia	1854	1-9,600	....do	1888.
Do	Schuylkill River, League Island to Grays Ferry	1313 *a*	1-5,000	H. G. Ogden	1873.
Do	Schuylkill River, Grays Ferry to Suspension Bridge	1313 *b*	1-5,000	....do	1873.
Do	Schuylkill River, Grays Ferry Bridge to Fairmount Dam.	1852	1-4,800	J. Hergesheimer	1888-89.
Pennsylvania and Delaware.	Chester to Naamans Creek △ª	1502 *a*	1-5,000	C. T. Iardella	1881.
Delaware	Naamans △ª to Lippincotts Wharf	1502 *b*	1-5,000	C. T. Iardella	1881.
Delaware and Pennsylvania.	Pennsylvania and Delaware boundary survey (topography and triangulation.)	2140	1-40,000	W. C. Hodgkins	1892-93.
Delaware	Lippincotts Wharf to Edgemoor Marsh	1507 *a*	1-5,000	C. T. Iardella	1881.
Do	Edgemoor Marsh to Maynes Ditch	1507 *b*	1-5,000	....do	1881.
Do	Maynes Ditch to Newcastle, Delaware River	1511 *a*	1-5,000	....do	1881.
Do	Newcastle to Reedy Point	1511 *b*	1-10,000	....do	1882.
Do	St. Georges Creek to Bombay Hook Light	1547 *a*	1-20,000	....do	1882.
Do	Position of proposed range lights near Port Penn	1600	1-5,000	F. C. Donn	1875.
Do	Position of proposed range lights near Listons Point	1601	1-5,000	....do	1875.
Do	Bombay Hook Light to Mahons River Light	1547 *b*	1-20,000	C. T. Iardella	1883.

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State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Delaware Bay and River—Continued.				
Delaware	Bombay Hook Island to Mispillion Creek	150	1-20,000	F. H. Gerdes	1842.
Do	Mahons River Light to △ⁿ Clark	1548 *a*	1-20,000	C. T. Iardella	1883.
Do	△ⁿ Clark to △ⁿ Plum	1548 *b*	1-20,000	....do	1884.
Do	From Mispillion Creek Light to Cape Henlopen	151	1-20,000	F. H. Gerdes	1842.
Do	Cape Henlopen and vicinity	1503	1-20,000	W. I. Vinal	1882.
Do	Cape Henlopen	1503 *bis*	1-20,000	E. Hergesheimer	1884.
Do	From Cape Henlopen to Indian River	226	1-20,000	J. J. S. Hassler	1845.
	Cape Henlopen to Cape Charles.				
Delaware	Cape Henlopen and vicinity	1503	1-20,000	W. I. Vinal	1882.
Do	Cape Henlopen	1503 *bis*	1-20,000	E. Hergesheimer	1884.
Do	From Cape Henlopen to Indian River	226	1-20,000	J. J. S. Hassler	1845.
Delaware and Maryland.	From Salt Pond Beach Signal to Dromedary Signal.	299	1-20,000	G. D. Wise	1850.
Maryland	From Beach House to South Birch	263	1-20,000	G. D. Wise and L. A. Sengteller.	1849-77.
Do	From head of Assateague Bay to Popes Island Beach	264	1-20,000	G. D. Wise	1850.
Do	From Popes Island Beach to Green River Inlet	311	1-20,000	.....do	1850.
Maryland and Virginia.	Assateague Island and vicinity	763	1-20,000	C. Ferguson	1859.
Do	From Chincoteague Inlet to Lonesome Hill	522	1-20,000	G. D. Wise	1849.
Do	.....do	524	1-20,000	.....do	1849.
Maryland	Chincoteague Island and vicinity	723	1-20,000	C. Ferguson and D. B. Wainwright.	1858-87.
Maryland and Virginia.	Chincoteague Bay and Inlet and part of Chincoteague Island.	704	1-20,000	N. S. Finney, G. D. Wise, and J. L. Tilghman.	1857.
Virginia	Line from Chincoteague Bay across the peninsula, Accomac County.	890 *a*	1-20,000	A. M. Harrison	1862.
Maryland and Virginia.	Map of boundary line	890 *b*	1-20,000	C. T. Iardella	1860.
Do	Pocomoke River and part of boundary line	890 *c*	1-20,000	.....do	1860.
Virginia	From Assawaman Inlet to Chincoteague Inlet	580	1-20,000	G. D. Wise and D. B. Wainwright.	1856-87.
Do	Wallops and Assawaman islands	378	1-20,000	W. M. Johnson	1851.
Do	From Metomkin Bay to Chincoteague Inlet	492	1-20,000	G. D. Wise	1855.
Do	From Gargathy to Wachapreague Inlet	464 *bis*	1-20,000	.....do	1852-54.
Do	Part of Accomac County, from Drummondtown to Onancock.	868	1-20,000	C. Hosmer and F. W. Dorr	1862.
Do	From Metompkin Inlet to Wachapreague Inlet	510	1-20,000	G. D. Wise	1852.
Do	From Wachapreague Inlet to Little Machipongo Inlet	512	1-20,000	.....do	1852.
Do	From Wachapreague Inlet to Great Machipongo Inlet.	1200	1-20,000	J. W. Donn	1871.
Do	Head of Machipongo River	1204	1-20,000	.....do	1871.
Do	From Great Machipongo Inlet to Sand Shoal Inlet	1201	1-20,000	J. W. Donn, L. B. Wright, and D. B. Wainwright.	1869-70-88.
Do	From Little Machipongo Inlet to Great Machipongo Inlet.	511	1-20,000	G. D. Wise	1852.
Do	From Great Machipongo Inlet to New Inlet, including Sand Shoal Inlet.	523	1-20,000	.....do	1853.
Do	Sand and Shoal Inlet to New Inlet, and from Eastville to Old Plantation Creek.	1202 *a*	1-20,000	J. W. Donn	1869-70.
Do	From Wreck Island to Cape Charles Light	1202 *b*	1-20,000	F. C. Donn and D. B. Wainwright.	1871-88.
Do	From Smiths Island to New Inlet	525	1-20,000	G. D. Wise	1852.
Do	Smiths Island, Cape Charles and vicinity	509	1-20,000	.....do	1852.
Do	Cape Charles Light to Old Plantation Creek	1203	1-20,000	J. W. Donn, L. B. Wright, and D. B. Wainwright.	1869-70-88.
	Chesapeake Bay, east side.				
Virginia	Smiths Island, Cape Charles and vicinity	509	1-20,000	G. D. Wise	1852.
Do	Cape Charles Light to Old Plantation Creek	1203	1-20,000	J. W. Donn, D. B. Wainwright, and L. B. Wright.	1869-70-88.
Do	From Cherrystone Creek to Butlers Bluff	495	1-20,000	J. Seib and D. B. Wainwright.	1852-88.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Chesapeake Bay, east side—Continued.				
Virginia	Sand and Shoal Inlet to New Inlet, and from Eastville to Old Plantation Creek.	1202 *a*	1-20,000	J. W. Donn	1869-70.
Do	Cherrystone Inlet	1534	1-10,000	E. Hergesheimer	1884.
Do	Occohannock, Naswaddox, and Hungers creeks, eastern shore.	350	1-20,000	J. Seib	1851.
Do	From Craddock Creek to Pongoteague Creek	307	1-20,000	J. Seib and S. A. Wainwright.	1850.
Do	From Pongoteague Creek to Beach Island	308	1-20,000	do	1850.
Do	Part of Accomac County, from Drummondtown to Onancock.	868	1-20,000	C. Hosmer and F. W. Dorr.	1862.
Do	Tangier, Watts, and Beach islands	309	1-20,000	J. Seib and S. A. Wainwright.	1850.
Virginia and Maryland.	Pocomoke Sound, from Deep Creek to Pocomoke River.	349	1-20,000	J. Seib	1851.
Do	From Little Fox Island to Big Annemessex River	272	1-20,000	J. Seib, S. A. Wainwright, and C. Junken.	1849-51-72.
Do	Pocomoke Sound, vicinity of Apes Hole Creek	528	1-20,000	S. A. Wainwright	1851.
Virginia	Pocomoke Sound, from Guilford Creek to Messongo Creek.	529	1-20,000	do	1851.
Virginia and Maryland.	Pocomoke River and part of boundary line	890 *c*	1-20,000	C. T. Iardella	1860.
Virginia	Line from Chincoteague Bay across the peninsula, Accomac County.	890 *a*	1-20,000	A. M. Harrison	1862.
Maryland	Smiths Island	271	1-20,000	J. Seib and R. D. Cutts	1849-72.
Do	Bloodsworth and South Marsh Island	269	1-20,000	J. Seib	1849.
Do	Deals Island to Big Annemessex River	270	1-20,000	J. Seib and S. A. Wainwright.	1849.
Do	Mouth of Honga River and Hoopers Straits	265	1-20,000	R. D. Cutts and J. Seib	1848.
Do	Head of Tangier Sound, including Wicomico River	268	1-20,000	J. Seib	1849.
Do	Fishing Bay and part of Nanticoke River	267	1-20,000	J. Seib and S. A. Wainwright.	1849.
Do	Nanticoke River, from Chapters Point to Vienna	266	1-20,000	do	1849.
Do	Tar Bay and upper part of Honga River	255	1-20,000	R. D. Cutts and J. Seib	1848.
Do	Meekins Neck, Chesapeake Bay	451	1-20,000	H. L. Whiting	1854.
Do	From Cooks Point to Meekins Neck, including Little Choptank River.	250	1-20,000	G. D. Wise	1847.
Do	Sharps Island	251	1-20,000	do	1848.
Do	Choptank River, Cooks Point to Hambrook Point	225	1-20,000	R. D. Cutts	1847.
Do	Choptank River, from Hambrook Point to Cabin Creek.	253	1-20,000	R. D. Cutts and J. Seib	1848.
Do	Choptank River, from Cabin Creek to Wings Landing.	254	1-20,000	do	1848.
Do	From Wades Point to Tilghmans Island, including Poplar Island.	215	1-20,000	G. D. Wise	1846-47.
Do	Chester River, Eastern Bay, Wye, and St. Michaels rivers, and Broad Creek.	223	1-20,000	R. D. Cutts	1847.
Do	Vicinity of Wye Island, St. Michaels River, and Tredhaven Creek.	224	1-20,000	R. D. Cutts	1847.
Do	Western shore of Kent Island, from Lose Point to Kent Point, and location of base line.	181	1-10,000	H. L. Whiting	1844.
Do	Eastern shore of Kent Island and Coxes Creek	222	1-20,000	R. D. Cutts	1847.
Do	Chester River, from its mouth to Piney Point	200	1-20,000	J. C. Neilson	1846.
Do	From Swan Creek to Eastern Neck Inlet	199	1-20,000	R. D. Cutts	1846.
Do	Chester River, from Piney Point north	201	1-20,000	J. C. Neilson	1846.
Do	From Worton Point to Swan Point, including Pools Island.	187	1-20,000	R. D. Cutts	1845.
Do	Chesapeake Bay, from Bush River to Turkey Point	212	1-20,000	G. D. Wise	1845.
Do	Sassafras River, vicinity of Lloyds Creek and Sassafras Creek.	469	1-20,000	H. L. Whiting	1854.
Do	Sassafras River, from Lloyds Creek to Swans Creek	279	1-20,000	J. J. S. Hassler	1846.
Do	South shore of Elk River, from Pond Creek to Cabin Johns Creek.	788	1-20,000	H. Adams	1860.

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State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Chesapeake Bay, east side—Continued.				
Maryland	Elk River, Bohemia River, and Back Creek	186	1-20,000	J. J. S. Hassler and H. L. Whiting.	1845-55.
Delaware and Maryland.	From Ash Signal to Riggs Hill, including head of Elk River (interior).	170	1-20,000	T. W. Werner	1843.
Do	From Wilmington to Maryland boundary (interior)	169	1-20,000	....do	1843.
Maryland	Head of Northeast River, Chesapeake Bay	184	1-10,000	J. J. S. Hassler	1844-45.
Do	Northeast River entrance, Chesapeake Bay	185 *bis*	1-10,000	....do	1844-45.
	Chesapeake Bay, west side.				
Maryland	Susquehanna River, including Havre de Grace and Port Deposit.	189	1-10,000	R. D. Cutts	1845.
Do	From Havre de Grace to Spesutie Narrows	188	1-10,000	....do	1845.
Do	Swan Creek to Bush River	190	1-20,000	....do	1845-46.
Do	Chesapeake Bay, from Bush River to Turkey Point	212	1-20,000	G. D. Wise	1845.
Do	Bush, Gunpowder, and Middle rivers	213	1-20,000	....do	1846-47.
Do	The intervening country between Bush River and Baltimore.	197	1-20,000	R. D. Cutts	1846.
Do	From Back River to Middle River, including Harts, Millers, and Pools islands.	450	1-20,000	H. L. Whiting	1854.
Do	Back River	214	1-20,000	G. D. Wise	1846-47.
Do	Patapsco Neck, from Bear Creek to North Point	436	1-20,000	H. L. Whiting	1853.
Do	North shore of Patapsco River, from Colgate Creek to Bear Creek.	401	1-20,000	H. L. Whiting and A. Boschke.	1852.
Do	Eastern shore of Patapsco River, from North Point to Colgate Creek.	219	1-20,000	G. D. Wise	1849.
Do	Duplicate of 217	217 *a*	1-10,000	....do	1845-46.
Do	Resurvey of Baltimore City	217	1-10,000	J. B. Glück	1849.
Do	Baltimore City and Harbor	216	1-10,000	G. D. Wise	1845.
Do	Patapsco River (original work)	221	1-20,000	....do	1847.
Do	Patapsco River, east side (duplicate)	218	1-20,000	....do	1845-46.
Do	South shore of Patapsco River, from Gibsons Island to Smiths Cove.	306	1-20,000	J. B. Glück and H. L. Whiting.	1851-55.
Do	Western shore of Patapsco River, from Bodkin Point to Ferry Point.	220	1-20,000	G. D. Wise	1845-46.
Do	From Sandy Point to Bodkin Point	175	1-10,000	F. H. Gerdes	1844.
Do	Magothy River	179	1-10,000	....do	1845.
Do	Steelton, Sparrows Point, Patapsco River	2032	1-10,000	J. W. Donn	1891.
Do	North shore of Patapsco River, Lazaretto Light to Bear Creek.	1004	1-10,000	C. T. Iardella	1866.
Do	Vicinity of Baltimore, northeast side	955	1-10,000	....do	1864.
Do	Vicinity of Baltimore, northwest side	936	1-10,000	C. M. Bache	1863.
Do	Vicinity of Baltimore, west side	977	1-10,000	C. T. Iardella	1865.
Do	....do	929	1-10,000	J. W. Donn	1863.
Do	Baltimore Harbor (sheet No. 1), from Hendersons Wharf to Pratt street.	1441 *a*	1-1,800	....do	1876.
Do	Baltimore Harbor (sheet No. 2), from Fort McHenry to Hendersons Wharf.	1441 *b*	1-1,800	J. W. Donn	1876.
Do	Baltimore Harbor (sheet No. 3), Lazaretto Light to Baltimore and Ohio ferry slip.	1442	1-1,800	....do	1876.
Do	Baltimore Harbor (sheet No. 4), Lazaretto Light to Ferry Point.	1443 *a*	1-3,600	....do	1876.
Do	Baltimore Harbor (sheet No. 5), vicinity of Ferry Point and Smiths Cove.	1443 *b*	1-3,600	R. M. Bache, W. F. Downer, and J. P. Bogart.	1875-76-77.
Do	South shore Patapsco River, Light Street Bridge to Swan Creek.	983	1-10,000	C. T. Iardella	1865.
Do	From Sandy Point to Thomas Point, including mouth of Severn River.	174	1-10,000	F. H. Gerdes	1844.
Do	Severn River, from Tallys Point to county bridge	1857	1-10,000	J. W. Donn	1888.
Do	Bay Ridge, Tallys Point	1861	1-5,000	....do	1888.
Do	Naval Academy and Cemetery	1860	1-5,000	....do	1888-89.
Do	Severn River, and from Hasketts Point to Tallys Point.	176	1-10,000	F. H. Gerdes	1844.

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State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Chesapeake Bay, west side—Continued.				
Maryland	Severn River, lower part	178	1-10,000	G. D. Wise	1844.
Do	Severn River, upper part	177	1-10,000	do	1844.
Do	Vicinity of South River	248	1-20,000	G. D. Wise and H. L. Whiting.	1847-55.
Do	South River	249	1-20,000	G. D. Wise	1847.
Do	From Saunders Point to Holland Point, including West River and Herring Bay.	198	1-20,000	R. D. Cutts	1846.
Do	From Parkers Creek northward	280	1-20,000	J. J. S. Hassler	1847.
Do	From Parkers Creek to Cove Point	281	2-20,000	do	1847.
Do	Cove Point, western shore of Chesapeake	388	1-20,000	J. Seib	1852.
Do	Mouth of Patuxent River	256	1-20,000	R. D. Cutts	1848.
Do	Hog Island, Patuxent River	2107	1-500	J. W. Donn	1893.
Do	Patuxent River, from St. Leonards Creek to Battle Creek.	812	1-10,000	H. Adams	1860.
Do	Patuxent River, from Battle Creek to Swansons Creek.	813	1-10,000	do	1860.
Do	Patuxent River, from Swansons Creek to Black Swamp Creek.	814	1-10,000	do	1859.
Do	Patuxent River, vicinity of Lower Marlboro	815	1-10,000	do	1859.
Do	From Cedar Point to Point-no-Point	257	1-20,000	R. D. Cutts and J. Seib	1848.
Do	Mouth of Potomac	458	1-20,000	do	1849-56.
	Potomac River.				
Maryland	St. Marys River	776	1-20,000	H. Adams	1858-59.
Do	St. Georges Island, St. Marys River	804	1-20,000	do	1859.
Do	From St. Georges River to Higgins Point, including St. Clements Bay and Bretons Bay.	1103	1-20,000	J. W. Donn	1868.
Do	Wicomico River and St. Catherines Sound and Island, with the shore line to Swan Point.	1105	1-20,000	do	1868.
Do	Potomac River, from Cob Point to Swan Point	858	1-20,000	C. Hosmer	1862.
Do	Potomac River, from Swan Point to Lower Cedar Point.	859	1-20,000	J. Mechan	1862.
Maryland and Virginia.	Potomac River, from Matomkin to Persimmon Point, including Port Tobacco River.	861	1-20,000	H. L. Whiting	1862.
Maryland	Potomac River, vicinity of Nanjemoy Creek	862	1-20,000	J. Mechan	1862.
Do	Potomac River, from Smiths Point to Nanjemoy Creek.	863	1-20,000	A. W. Longfellow	1862.
Maryland and Virginia.	Potomac River, from Aquia Creek and Smiths Point to Shipping Point.	865	1-20,000	C. Hosmer	1862.
Maryland	Potomac River, from Budds Ferry to Indian Head	866	1-20,000	A. W. Longfellow	1862.
Maryland and Virginia.	Potomac River, from Indian Head to Fox Ferry	875	1-20,000	C. Hosmer	1862.
Maryland	From Broad Creek to Oxen Creek	902	1-10,000	A. M. Harrison	1863.
Do	Vicinity of Rosiers Bluff	895	1-5,000	do	1862.
Maryland and Virginia.	Potomac River, from Jones Point to Little Falls Bridge.	910*a*	1-15,000	C. H. Boyd and J. Hergesheimer.	1863-74.
Maryland	Site of United States naval magazine, near Marbury Point.	910*b*	1-1,200	J. Hergesheimer	1874.
District of Columbia and Maryland.	Southeast portion of District of Columbia and adjacent country.	925	1-15,000	J. W. Donn	1863.
District of Columbia.	Northeast corner District of Columbia, showing Forts Chapin, Mahan, Sedgwick, and Battery Craven.	1036	1-10,000	C. M. Bache and J. Hergesheimer.	1865-74.
Do	Northeast side District of Columbia	950	1-15,000	C. Ferguson and H. Adams.	1863-64.
Maryland	From Bladensburg to Leesboro, adjacent to District of Columbia.	903	1-15,000	C. Ferguson	1863.
District of Columbia and Virginia.	Potomac River, from Georgetown to Little Falls	1340	1-2,500	C. Junken	1872.
Virginia	Tennallytown to Great Falls	945	1-15,000	F. W. Dorr	1864.
Do	Tennallytown to Rockville	940	1-15,000	J. W. Donn and C. Rockwell.	1864.
Do	Chain Bridge to Prospect Hill	944	1-15,000	F. W. Dorr	1864.

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	Potomac River—Continued.				
Maryland and Virginia.	Potomac River, from Great Falls to Rushville	990	1-10,000	J. W. Donn and McL. W. Thomson.	1865.
Do	Potomac River, from Rushville to Youngs Ford	989	1-10,000	do	1865.
Do	Potomac River, from Youngs Ford to Whites Ferry	988	1-10,000	do	1865.
Do	Potomac River, from Whites Ferry to Masons Island No. 2.	987	1-10,000	do	1865.
Do	Potomac River, from east end of Heters Island to Berlin.	986	1-10,000	do	1865.
Maryland and West Virginia.	Potomac River, from Berlin to Harpers Ferry	985	1-10,000	J. W. Donn, H. L. Marindin, and McL. W. Thomson.	1865.
Do	Potomac River, from Fort Duncan to High Knob	1013	1-10,000	J. W. Donn	1865-66.
Do	Potomac River, from High Knob to Shepherdstown	1014	1-10,000	do	1866.
Do	Vicinity of Williamsport (military survey)	879	1-20,000	C. Hosmer and J. Mechan.	1862.
District of Columbia.	Defenses of Washington	1960	1-31,680		1863-64.
Maryland, Virginia, and West Virginia.	Vicinity of Harpers Ferry, Charlestown, and Hagerstown.	1906	1-10,000	H. F. Walling	1881.
Virginia and West Virginia.	Vicinity of Martinsburg	1907	1-42,000	do	1881.
Do	Vicinity of Winchester	1908		do	1881.
Virginia	Vicinity of Fort Ethan Allen and Fort Marcy	551	1-15,000	T. W. Robbins	1864.
Do	Aqueduct to Little Falls	943	1-15,000	F. W. Dorr	1864.
Do	Baileys Cross Roads to Miners Hill	942	1-15,000	C. Rockwell	1864.
Do	Part of Arlington	1025	1-1,200	E. Hergesheimer and R. E. McMath.	1864.
Do	do	1026	1-1,200	do	1864.
Do	Site of proposed base line, Fort Whipple Reservation.	1461	1-1,200	A. Lindenkohl	1878.
Do	Alexandria to Baileys Cross Roads	941	1-15,000	F. W. Dorr	1864.
Do	Jones Point, near Alexandria	905	1-1,000	A. M. Harrison	1863.
Do	Vicinity of Jones Point, near Alexandria	909	1-1,000	C. M. Bache	1863.
Do	Alexandria to Burkes Station, including Springfield and Annandale.	949	1-15,000	F. W. Dorr	1864.
Do	Vicinity of Fort Lyon	916	1-10,000	C. M. Bache	1863.
Do	Alexandria to Mount Vernon	947	1-15,000	J. Mechan	1864.
Do	Dogue Run to Fairfax Road, Fairfax County, General Heintzelman's division.	948	1-15,000	do	1861.
Do	Potomac River, from Shipping Point to High Point	867	1-20,000	do	1862.
Do	Reconnoissance of roads between Fredericksburg and Potomac Creek.	873	1-10,000	T. W. Robbins	1862.
Do	Potomac River from Matomkin Point to Marlboro Point.	864	1-20,000	J. Mechan	1862.
Do	Potomac River, from Mattox Creek to Persimmon Point.	860	1-20,000	do	1862.
Do	Potomac River, from Mattox Creek to Nomini Cliffs	1106	1-20,000	J. W. Donn	1868.
Do	Potomac River, south shore, between Popes Creek and Mattox Creek, showing site of Washington's birthplace.	1467	1-10,000	A. Lindenkohl	1879.
Maryland	Nomini and Currioman bays, with Nomini Creek and Lower Machodoc River, and shore line east of Jacksons Creek.	1104	1-20,000	J. W. Donn	1868.
Virginia	Potomac River, from Kingcopsico Point to Sandy Point, including Blakistone Island.	1581	1-20,000	S. A. Wainwright	1860.
Do	Yeocomico and Coan rivers, south shore of Potomac.	1102	1-20,000	J. W. Donn	1868.
	District of Columbia.				
District of Columbia.	District of Columbia, water front from Four Mile Run to Jones Point.	2024	1-4,800	D. B. Wainwright	1891.
Do	District of Columbia water front, from Analostan Island to Four Mile Run.	2023	1-4,800	do	1891.
Do	District of Columbia water front, Aqueduct Bridge to Seventh Street Wharf.	2028	1-4,800	J. W Donn and J. A. Flemer.	1891.

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	District of Columbia—Continued.				
District of Columbia.	District of Columbia water front, navy-yard to Seventh Street Wharf, including part of reclaimed river flats.	2029	1-4,800	J. A. Flemer	1891.
Do	South corner of District	1961	1-4,800	do	1889.
Do	Southeastern part of District, vicinity of Giesboro Road.	1976	1-4,800	do	1890.
Do	District of Columbia, Giesboro Point and vicinity	1988	1-4,800	D. B. Wainwright	1889-90.
Do	District of Columbia, vicinity of Oxon Run	1987	1-4,800	do	1890.
Do	District of Columbia, Insane Asylum and vicinity	1962	1-4,800	do	1889-90.
Do	District of Columbia, inspection sheet, vicinity of Anacostia.	1963	1-4,800	J. W. Donn	1890.
Do	Eastern Branch and eastward, Anacostia Bridge to Baltimore and Potomac Railroad Bridge.	1948	1-4,800	J. A. Flemer	1888-89.
Do	Along northeast boundary, vicinity of Bowen Road	1949	1-4,800	do	1890.
Do	District of Columbia, along northeast boundary north of Bennings Road.	1978	1-4,800	do	1889-90.
Do	District of Columbia, northeast corner	1977	1-4,800	J. W. Donn	1890.
Do	Vicinity of Bennings Bridge	1801	1-4,800	W. C. Hodgkins	1888.
Do	do	1801 *a*	1-4,800	do	1888.
Do	District of Columbia (sheet No. 10, east)	1821	1-4,800	J. W. Donn and W. C. Hodgkins.	1888(?)-9
Do	District of Columbia (sheet No. 1, east)	1761	1-4,800	J. W. Donn	1887-88 (?).
Do	Experimental square mile	2075			
Do	Between Ivy City and Eastern Branch	1800	1-4,800	W. C. Hodgkins	1887-88.
Do	do	1800 *a*	1-4,800	do	1887-88.
Do	District of Columbia (sheet No. 3, east)	1820	1-4,800	J. W. Donn	1888 (?)-91.
Do	District of Columbia (sheet No. 1, west)	1770	1-4,800	do	1886 (?).
Do	District of Columbia (sheet No. 2, west)	1767	1-4,800	do	1886 (?).
Do	District of Columbia (sheet No. 3, west)	1740	1-4,800	do	1886 (?).
Do	District of Columbia, from the boundary, between North Capitol and Sixteenth Streets, NW., northeasterly to District line, including Soldiers' Home, etc.	2041	1-4,800	do	1881-82 (?).
Do	District of Columbia (sheet No. 4, west)	1714	1-4,800	J. W. Donn, D. B. Wainwright, W. C. Hodgkins, and J. A. Flemer.	1880.
Do	District of Columbia (sheet No. 5, west)	1715	1-4,800	do	1880.
Do	Site for the new Naval Observatory	1488	1-1,200	C. Junken and F. C. Donn.	1881.
Do	Naval Observatory Circle	2171	1-1,600	E. D. Preston	1894.
Do	District of Columbia (sheet No. 6, west)	1716	1-4,800	W. C. Hodgkins, J. W. Donn, D. B. Wainwright, and J. A. Flemer.	1880.
Do	District of Columbia, northwestern margin of city limits, including part of Rock Creek, etc.	2042	1-4,800	J. W. Donn	1881-82.
Do	District of Columbia (sheet No. 7, west)	1717	1-4,800	J. W. Donn, D. B. Wainwright, W. C. Hodgkins, and J. A. Flemer.	1880.
Do	District of Columbia (sheet No. 8, west)	1718	1-4,800	do	1880.
Do	District of Columbia (sheet No. 9, west), vicinity of Brightwood and northward.	1819	1-4,800	J. W. Donn	1888.
Do	District of Columbia, Mount Pleasant, Brightwood, etc., northeasterly to District line.	2043	1-4,800	do	1881-83 (?).
Do	District of Columbia (sheet No. 10, west)	1745	1-4,800	do	1884 (?).
Do	District of Columbia (sheet No. 11, west)	1751	1-4,800	do	1884 (?).
Do	District of Columbia, vicinity of receiving reservoir.	2010	1-4,800	J. A. Flemer	1890-91.
Do	District of Columbia (sheet No. 12, west)	1758	1-4,800	J. W. Donn	1883 (?).
Do	District of Columbia (sheet No. 13, west)	1759	1-4,800	do	1883 (?).
Do	District of Columbia, head waters of Broad Branch, northwest of Tennallytown.	1983	1-4,800	do	1890-91.
Do	District of Columbia (sheet No. 14, west)	1760	1-4,800	do	1884 (?).
Do	District of Columbia, vicinity of Rock Creek Ford Road and Daniels Road.	1989	1-4,800	D. B. Wainwright	1890.

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	District of Columbia—Continued.				
District of Columbia	District of Columbia, vicinity of Rock Creek Ford Road.	1990	1-4,800	J. A. Flemer	1890.
Do	District of Columbia, along northwestern boundary and northeast of Broad Branch Road.	2022	1-4,800	W. C. Hodgkins	1891.
Do	District of Columbia, along northwestern boundary, vicinity of Daniels Road.	2021	1-4,800	J. A. Flemer	1890-91.
Do	District of Columbia, north corner	2020	1-4,800	J. W. Donn	1890-91.
Do	District of Columbia (sheet No. 15, west)	1752	1-4,800	do	1883 (?).
	Chesapeake Bay, west side, Potomac River to and including Rappahannock River.				
Virginia	Little and Great Wicomico rivers	500	1-20,000	J. Seib	1850-56.
Do	Part of Ingrams Bay, Dividing Creek, and Fleets Bay.	310	1-20,000	J. Seib and S. A. Wainwright.	1850.
Do	Mouth of Rappahannock River	521	1-20,000	J. Seib	1851-56.
Do	Rappahannock River, vicinity of Greys Point and Cherry Point.	660	1-10,000	H. Adams	1857.
Do	Rappahannock River, from Carters Creek to Baileys Bluff.	659	1-10,000	do	1857.
Do	Corrotoman River	661	1-10,000	do	1857.
Do	Rappahannock River, vicinity of Vibanna and Beach Creek.	603	1-10,000	do	1856.
Do	Rappahannock River, from La Grange Creek to Punch Bowl.	602	1-10,000	do	1856.
Do	Estuaries of the Rappahannock River, vicinity of Corrotoman River (hydrographic).	1001	1-20,000	J. W. Donn	1869.
Do	Rappahannock River, from Punch Bowl to Jones Point.	520	1-10,000	A. Strauss and J. Seib	1855.
Do	Rappahannock River, from Jones Point to Accacreek Point.	519	1-10,000	do	1855.
Do	Rappahannock River, from Accacreek Point to Tappahannock.	518	1-10,000	do	1855.
Do	Rappahannock River, from Tappahannock to Accupacia Creek.	517	1-10,000	do	1855.
Do	Rappahannock River, from Accupacia Creek to Leedstown.	516	1-10,000	do	1855.
Do	Rappahannock River, from Leedstown to Green Bay.	515	1-10,000	do	1855.
Do	Rappahannock River, from Port Tobago Bay to Port Royal.	514	1-10,000	J. Seib	1854.
Do	Rappahannock River, from Mill Bank Creek to Skinkers Neck.	513	1-10,000	do	1853-54.
Do	Rappahannock River, from Skinkers Neck to Belvedere.	435	1-10,000	do	1853-54.
Do	Rappahannock River, from Belvedere to Falmouth.	434	1-10,000	do	1853.
Do	Rappahannock River, left bank, vicinity of Fredericksburg.	872	1-10,000	T. W. Robbins	1862.
Do	Rappahannock River, left bank, vicinity of Falmouth and Fredericksburg.	871	1-10,000	C. M. Bache	1862.
Do	Reconnaissance of roads between Fredericksburg and Potomac Creek.	873	1-10,000	T. W. Robbins	1862.
	Rappahannock River to Hampton Roads.				
Virginia	Piankatank River	1100	1-20,000	J. W. Donn	1869.
Do	From Wolf Trap to Piankatank River, including head of East River.	503	1-20,000	J. Seib	1853.
Do	New Point Comfort to Wolf Trap, including Mobjack Bay.	504	1-20,000	do	1853.
Do	Mobjack Bay, North, Ware, and Severn rivers	1101	1-20,000	G. D. Wise and J. W. Donn.	1860-68.
Do	Mouth of York River, Chesapeake Bay	496	1-20,000	J. Seib	1853-54.
Do	York River, from Wormleys River to Clay Bank	685	1-20,000	do	1857.
Do	Back and Poquosin rivers	499	1-20,000	do	1853-54.
Do	Mouth of York River, Chesapeake Bay	496	1-20,000	do	1853-54.
Do	York River, from Wormleys River to Clay Bank	685	1-20,000	do	1857.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

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	Rappahannock River to Hampton Roads—Continued.				
Virginia	York River, from Clay Bank to Mount Folly	686	1-20,000	J. Seib	1857-58.
Do	York River, from Mount Folly to West Point	722	1-20,000	do	1858.
Do	Entrance of Hampton Roads and Back River	502	1-20,000	J. Seib, A. M. Harrison, and H. P. Ritter.	1853-54-62-92.
Do	Hampton Roads and James River (entrance)	501	1-20,000	J. Seib	1853.
Do	Newport News Point	1008	1-10,000	E. Hergesheimer	1865.
	James River.				
Virginia	James River entrance	497	1-20,000	J. Seib	1853.
Do	James River, Newport News to Pagan Creek	1265	1-20,000	J. W. Donn, F. C. Donn, and S. N. Ogden.	1871-72.
Do	James River, Pagan Creek to Point of Shoals Light-House.	1266	1-20,000	do	1871-72-73.
Do	James River, Burwells Bay to College Creek	1289	1-20,000	J. W. Donn and F. C. Donn.	1873.
Do	James River, from College Creek to Chickahominy River.	1290	1-20,000	J. W. Donn	1873-74.
Do	Chickahominy River, from entrance to Wilcox Neck.	1337 *a*	1-20,000	J. W. Donn and F. C. Donn.	1873-74.
Do	Chickahominy River, from Wilcox Neck to head of river.	1337 *b*	1-20,000	do	1874-75.
Do	James River, from Dillards Wharf to Chippoak Creek.	1391 *a*	1-20,000	J. W. Donn	1874-75.
Do	James River, from Sloop Point to City Point	1391 *b*	1-20,000	do	1875.
Do	James River, from City Point to Cogains Point	431	1-10,000	J. Seib	1853.
Do	James River, from Curls Neck to City Point	430	1-10,000	do	1853.
Do	Part of Appomattox River, from City Point to Port Walthall.	390	1-10,000	do	1853.
Do	Part of Appomattox River, with Petersburg	389	1-10,000	do	1853.
Do	Appomattox River, from Gatlings Wharf to James River.	2105	1-10,000	C. H. Boyd	1892.
Do	Appomattox River, from Petersburg to Gatlings Wharf.	2095	1-10,000	do	1892-93.
Do	James River, from City Point to Curls Neck	1438	1-10,000	J. W. Donn and F. C. Donn.	1877.
Do	James River, from Curls Neck to Graveyard Reach.	1439	1-10,000	J. W. Donn	1877.
Do	James River, vicinity of Trents Reach	393		S. A. Wainwright	1853.
Do	James River, from Dutch Gap to Curls Neck	429	1-10,000	J. Seib	1853.
Do	James River, from Wilton to Dutch Gap	428	1-10,000	do	1853.
Do	James River, from Warwick Bar to Richmond Bar	392	1-5,000	S. A. Wainwright	1853.
Do	James River, from Mayos Bridge to Drurys Island	391	1-5,000	do	1853.
Do	City of Richmond	684	1-5,000	H. Adams	1857-58.
Do	James River, from Mayos Bridge, Richmond, to Lower Rocketts.	1493 *a*	1-10,000	J. W. Donn	1879-80.
Do	James River, from Lower Rocketts to Graveyard Reach.	1493 *b*	1-10,000	do	1879-80.
	Nansemond River.				
Virginia	Nansemond River, from mouth to Campbells Creek.	1353	1-10,000	C. M. Bache, H. M. De Wees, and W. Gilbert.	1874.
Do	Nansemond River	505	1-20,000	J. Seib	1853.
Do	Nansemond River, from Campbells Creek north	1352 *a*	1-10,000	C. M. Bache, H. M. De Wees, and W. Gilbert.	1874.
Do	Nansemond River, vicinity of Suffolk (upper sheet).	1352 *b*	1-10,000	do	1874.
Do	Nansemond River, vicinity of Suffolk (△ⁿ sheet)	1591	1-10,000	do	1874.
Do	Plane table △ⁿ of Nansemond River	1598	1-10,000	C. M. Bache	1874.
	Norfolk and vicinity.				
Virginia	Craney Island to Nansemond River	1897	1-10,000	C. M. Bache	1883.
Do	Tanners Point to Fort Norfolk, eastern shore of Elizabeth River.	1499 *a*	1-10,000	C. M. Bache, E. Ellicott, J. B. Boutelle, and H. P. Ritter.	1882-92.
Do	Plans of Confederate fortifications, Elizabeth River and vicinity.	851	1-2,500	A. M. Harrison	1862.
Do	Craney Island	1376	1-1,200	J. W. Donn and F. C. Donn.	1874.
Do	Elizabeth River (entrance)	498	1-20,000	J. Seib	
Do	Tanners Point to Fort Norfolk, eastern shore of Elizabeth River.	1499 *a*	1-10,000	C. M. Bache, E. Ellicott, J. B. Boutelle, and H. P. Ritter.	1882-92.

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	Norfolk and vicinity—Continued.				
Virginia	Norfolk Harbor, additions to wharf line and Norfolk and Western Railroad.	1936	1-10,000	J. W. Donn	1890.
Do	Norfolk, Portsmouth, and Gosport	1332	1-10,000	J. W. Donn, C. M. Bache, and H. M. De Wees.	1873-74.
Do	Norfolk Harbor, new wharves and changes in old wharves.	1958	1-5,000	F. C. Donn	1882.
Do	United States navy-yard at Gosport and battery at St. Helena.	850	1-2,500	A. M. Harrison	1862.
Do	City fronts of Norfolk Harbor	506	1-10,000	J. Seib	1856.
Do	Southern Branch, Elizabeth River	1387 *c*	1-20,000	J. W. Donn	1873.
Do	Eastern Branch, Elizabeth River	1387 *b*	1-20,000	J. W. Donn and F. C. Donn	1873.
Do	Part of Tanners Creek, Elizabeth River	1387 *a*	1-10,000	.....do	1873.
Do	Northeast of Norfolk	1462 *a*	1-20,000	C. M. Bache	1876-77-82.
Do	From Inlet Creek to Lynn Haven River	1462 *b*	1-20,000	.....do	1877-78.
Do	From Willoughbys Point to Cape Henry	507	1-20,000	J. Seib	1852.
Do	Lynn Haven Bay and vicinity	1659	1-20,000	E. Ellicott	1884.
Do	Cape Henry and vicinity	753	1-20,000	J. Mechan and J. J. S. Hassler.	1859.
	Cape Henry to Cape Hatteras.				
Virginia	Cape Henry and vicinity	753	1-20,000	J. Mechan and J. J. S. Hassler.	1859.
Do	Back Bay and North Bay	743	1-20,000	J. Mechan	1859.
Do	Head of North and Landing rivers	754	1-20,000	.....do	1859.
Virginia and North Carolina.	Chesapeake and Albemarle Canal with Landing and North rivers (hydrographic).	1579 *b*	1-20,000	G. C. Hanus	1884.
Do	From Back Bay to Currituck Sound, including North and Landing rivers.	736	1-20,000	J. Mechan and J. J. S. Hassler.	1858.
North Carolina	Currituck Sound, upper part	657	1-20,000	H. Adams	1857.
Do	Currituck Sound, from Currituck Beach Light, south.	381	1-20,000	J. J. S. Hassler	1851-52.
Do	Currituck Sound, from Jews Quarter Island to Collinston Island, including North River.	292	1-20,000	.....do	1848-49.
Virginia and North Carolina.	Chesapeake and Albemarle Canal, with Landing and North rivers (hydrographic).	1579 *c*	1-20,000	G. C. Hanus	1884.
North Carolina	Kill Devil Hills to Nags Head, including part of Roanoke Island.	351	1-20,000	J. J. S. Hassler	1851.
Do	Bodies Island, from Nags Head to Oregon Inlet	354	1-20,000	A. W. Longfellow	1849.
Do	Bodies Island	791	1-20,000	J. Mechan	1860.
Do	Vicinity of New Inlet and Loggerhead Inlet	367	1-20,000	H. Adams	1852.
Do	From Cape Hatteras north	377	1-20,000	.....do	1852.
	Albemarle Sound.				
North Carolina	Pasquotank River	207	1-20,000	J. C. Neilson	1847.
Do	Omissions at Camden Point, Albemarle Sound	837	1-20,000	J. Mechan	1861.
Do	Albemarle Sound, vicinity of Big Hatty Cove	208	1-20,000	J. C. Neilson	1847.
Do	Little River and Durants Neck	209	1-20,000	.....do	1847.
Do	Perquimans River and Harveys Neck	210	1-20,000	.....do	1848.
Do	Albemarle Sound, Drummond and Laurel points, to Sandy Point.	211	1-20,000	J. J. S. Hassler	1848.
Do	Albemarle Sound, from Edenton to Sandy Point and the south shore.	247	1-20,000	.....do	1848.
Do	Mouth of Chowan River, Albemarle Sound	824	1-20,000	J. Mechan and H. Adams	1860-61-74.
Do	Chowan River, from its mouth to Coleraine	1335 *a*	1-20,000	H. Adams	1874.
Do	Chowan River, from Coleraine to Harrells Landing	1335 *b*	1-20,000	.....do	1874.
Do	Batchelors Bay, Swans Bay, and mouth of Roanoke River.	836	1-20,000	J. Mechan	1861.
Do	Roanoke, Eastmost, Middle, and Caskai rivers	922	1-20,000	R. E. Halter	1864.
Do	South shore Albemarle Sound, Long Shoal Point to Laurel Point.	246	1-20,000	J. J. S. Hassler	1848.
Do	Entrance to Alligator River	284	1-20,000	A. W. Longfellow	1849.
Do	Head of Alligator River	285	1-20,000	.....do	1849.
Do	Alligator River (hydrographic reconnoissance of)	1315	1-20,000	R. Wainwright, U. S. N.	1876.
Do	East Lake and South Lake, Albemarle Sound	825	1-20,000	J. Mechan	1861.
Do	Durants Island and Croatan Sound, from Haulover to Redstone Point.	293	1-20,000	J. J. S. Hassler	1848-49.

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	Albemarle Sound—Continued.				
North Carolina....	Croatan Sound, from Hog Island to Redstone Point..	933	1-20,000	R. E. Halter...............	1864.
Do............	Part of Roanoke Island, from Shallowbag Bay to Broad and Oyster creeks.	826	1-20,000	J. Mechan................	1861.
	Cape Hatteras to Cape Lookout.				
North Carolina....	Cape Hatteras to Hatteras Inlet......................	1246	1-20,000	C. T. Iardella and W. C. Hodgkins.	1872.
Do............	Hatteras Inlet..	623	1-10,000	J. Mechan................	1857.
Do............	.....do..	372	1-20,000	H. Adams	1852.
Do............	From Hatteras Inlet to Great Swash.................	792	1-20,000	J. Mechan and C. Fendall.	1860-66.
Do............	Ocracoke Inlet	376	1-20,000	H. Adams	1852.
Do............	... .do..	622	1-10,000	J. Mechan and C. Fendall.	1857-66.
Do............	Ocracoke Inlet and Bar (hydrographic)..............	1364	1-20,000	R. Wainwright, U. S. N...	1877.
Do............	Portsmouth Island and Cove Beach............	1016	1-20,000	C. Fendall................	1866.
Do............	Core Sound, from Hog Island to Cedar Inlet..........	1020	1-20,000	W. H. Dennis....	1866.
Do............	Core Sound, from Cedar Inlet to Bells Point..........	1017	1-20,000	.....do.....................	1856.
Do............	Cape Lookout and part of Core Sound and approaches to Beaufort Harbor.	416	1-20,000	A. S. Wadsworth..........	1853.
Do............	Part of Cape Lookout...........	1695	1-20,000	W. C. Hodgkins..........	1886.
	Pamplico Sound.				
North Carolina....	Croatan Sound, from Hog Island to Redstone Point..	933	1-20,000	R. E. Halter...............	1864.
Do............	Pamplico Sound, from Pingleton Point to Roanoke Marsh Light-House.	1385	1-20,000	C.T.Iardella, H.W.Bache, and W.Fraser.	1875.
Do............	Pamplico Sound, from Yesocking Point to Pingleton Point.	1384 *b*	1-20,000	.....do.....................	1874-75.
Do............	Pamplico Sound, from Juniper Bay to Yesocking Point.	1384 *a*	1-20,000	.....do.....................	1874-75.
Do............	Pamplico Sound, from Juniper Bay to Bells Bay......	1355	1-20,000	C. T. Iardella and H. W. Bache.	1873-74.
Do............	Pungo River, from Wades Point to Pungo Creek.....	1273	1-20,000	F. W. Dorr aud W. E. Mc-Clintock.	1872.
Do............	Head of Pungo River, and from Yatesville to Leachville.	1310	1-20,000	.....do.....................	1873.
Do............	Pamplico River, from Pamplico Point to Indian Island, including Oyster, Goose, and Bonds creeks, and mouth of Pungo River.	1213	1-20,000	F. W. Dorr	1870.
Do............	Pamplico River, from Adams Point to Rumley Marsh, including North and South creeks.	1212	1-20,000	.... do.....................	1870.
Do............	Pamplico River, from Rumley Marsh to Ragged Point, including Bath and Durhams creeks.	1210	1-20,000	F. W. Dorr, C. T. Iardella, and A. P. Barnard.	1871.
Do............	Pamplico River, from Mauls Point to Rodmans Point, including Blounts, Broad, and Upper Goose creeks and Chocoumity Bay.	1211	1-20,000	.....do.....................	1870-71.
Do............	Washington and vicinity..............................	1274	1-10,000	F. W. Dorr and W. E. Mc-Clintock.	1871-72.
Do............	Western shore of Pamplico Sound, from Jones Bay to Pamplico Point.	1095	1-20,000	F. W. Dorr, H. W. Bache, and J. Hergesheimer.	1868-69.
Do............	Bay River...	1094	1-20,000	.....do.....................	1869.
Do............	Neuse River, from Smiths Creek and Cedar Point to to Piney Point and Browns Creek.	1073	1-20,000	F. W. Dorr and H. W. Bache.	1868.
Do............	Neuse River, from Wilkinson Point to Cedar Point...	1052	1-20,000	F. W. Dorr and L. A. Sengteller.	1867-70.
Do............	Neuse River, from Beards Creek to Wilkinsons Point.	1051	1-20,000	.....do.....................	1867.
Do............	Neuse River, from Johnsons Point to Beards Creek..	1018	1-20,000	F. W. Dorr................	1866.
Do............	Neuse River, from New Berne to Johnsons Point....	1031	1-10,000	.....do.....................	1866.
Do............	Shore line Neuse River, vicinity of New Berne......	928	1-20,000	A. Strauss.................	1863-64.
Do............	Neuse River, south shore, from Browns Creek to Point of Marsh.	1074	1-20,000	F. W. Dorr................	1868.
Do............	Cedar Island and vicinity............................	1277 *a*	1-20,000	C. T. Iardella.............	1872.
Do............	Head of Long Bay....................................	1277 *b*	1-20,000	.....do........	1872.
Do............	Main shore of Core Sound, from Halls Point to Bells Point.	1306	1-20,000	.....do.....................	1873.

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	Cape Lookout to Cape Fear.				
North Carolina....	Beaufort Harbor....	315	1-10,000	H. L. Whiting....	1851.
Do....	Beaufort Harbor, resurvey of shore line....	874	1-10,000	A. Boschke....	1862.
Do....	Beaufort Harbor (rejected)....	348	1-10,000	C. P. Bolles....	1851.
Do....	Vicinity of Beaufort Harbor....	438	1-20,000	A. S. Wadsworth....	1854.
Do....	North and Newport rivers....	1328	1-20,000	C. M. Bache, H. M. De Wees, and H. W. Bache.	1873.
Do....	Bogue Sound, from Hooppole Creek to Broad Creek	1110	1-20,000	A. W. Longfellow....	1867.
Do....	Bogue Sound, from Broad Creek to Queens Creek, including Swansboro and Bogue Inlet.	1215	1-20,000	H. Adams and C. M. Bache.	1871.
Do....	From Bear Inlet to New River Inlet....	1291	1-20,000	C. M. Bache....	1872.
Do....	New River and part of Stump Sound....	558	1-10,000	J. Mechan and A. S. Wadsworth.	1856.
Do....	Resurvey of New River Inlet (hydrography)....	1841	1-10,000	W. C. Hodgkins....	1888.
Do....	Topsail and Stump sounds....	565	1-10,000	J. Mechan, A. S. Wadsworth, and D. B. Wainwright.	1856-88.
Do....	Topsail Sound, from Stump Inlet to Old Topsail Inlet.	711	1-20,000	J. Mechan....	1857-58.
Do....	From Sidbury Inlet to Rich Inlet, including part of Topsail Sound.	617	1-10,000	J. Mechan and A. S. Wadsworth.	1857.
Do....	Middle and Topsail sounds....	618	1-10,000	J. Mechan, A. S. Wadsworth, and D. B. Wainwright.	1857-87.
Do....	Masonboro and Middle sounds....	619	1-10,000	....do....	1857-87.
Do....	Myrtle Sound....	620	1-10,000	....do....	1857-88.
Do....	Big Pond to Federal Point....	621	1-10,000	....do....	1857-88.
Do....	New Inlet, including Federal Point, Smiths and Zeeks islands.	999	1-10,000	J. S. Bradford....	1865.
Do....	Attack on Fort Fisher....	1995	1-10,000	....do....	1865.
Do....	Cape Fear River, vicinity of Federal Point and Snows Marsh.	344	1-10,000	C. P. Bolles....	1851-52-56.
Do....	Cape Fear River entrance, Oak Island and upper part of Smiths Island, including Southport.	345	1-10,000	....do....	1851.
Do....	Cape Fear River and approaches, from Buzzard Bay to Federal Point.	709	1-10,000	C. P. Bolles and O. Hinrichs.	1858.
Do....	Cape Fear, entrance....	708	1-10,000	....do....	1858.
Do....	From Smiths Island to Federal Point....	1756	1-10,000	D. B. Wainwright....	1887.
Do....	Interior of Smiths Island, Cape Fear River....	1464 *b*	1-20,000	C. T. Iardella....	1879.
Do....	Cape Fear River, from Cape Fear Point to Ortons Creek.	1464 *a*	1-20,000	....do....	1878.
Do....	Lower part of Smiths Island, Cape Fear....	346	1-10,000	C. P. Bolles....	1851-56.
Do....	Cape Fear River, from Peters Point to Liliput Creek..	446	1-10,000	....do....	1853.
Do....	Cape Fear River and vicinity of Campbell Island....	449	1-10,000	....do....	1853.
Do....	From Ortons Creek to Eagles Island....	1463 *b*	1-20,000	C. T. Iardella....	1878.
Do....	Cape Fear River and mouth of Brunswick River and Redmond Creek.	447	1-5,000	C. P. Bolles....	1853.
Do....	Cape Fear River, vicinity of Wilmington....	448	1-5,000	....do....	1853.
Do....	Vicinity of Wilmington....	1463 *a*	1-20,000	C. T. Iardella....	1877.
	Cape Fear River to Charleston.				
North Carolina....	Cape Fear River entrance....	1771	1-10,000	D. B. Wainwright....	1887.
Do....	From Cape Fear River entrance northward to Ash Swamp.	674	1-10,000	C. P. Bolles and G. H. Bagwell.	1852.
Do....	Ash Swamp to Lockwoods Folly Inlet....	673	1-10,000	C. P. Bolles, G. H. Bagwell, and W. S. Edwards.	1856.
Do....	Lockwoods Folly Inlet to Bacons Inlet....	672	1-10,000	C. P. Bolles and O. Hinrichs.	1857.
Do....	Bacons Inlet to Gauses Landing....	725 *a*	1-10,000	....do....	1858-59.
Do....	From Gauses Landing to Little River Inlet....	725 *b*	1-10,000	C. P. Bolles....	1858.
Do....	Tubbs Inlet and Little River Inlet....	1959	1-10,000	....do....	1859-60.
North Carolina and South Carolina.	From Little River Inlet to Kettle Swash....	1295 *b*	1-20,000	O. H. Tittmann and D. B. Wainwright.	1873.
North Carolina....	From Kettle Swash to Big Swamp....	1295 *a*	1-20,000	....do....	1873.

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	Cape Fear River to Charleston—Continued.				
South Carolina....	From Big Swamp to Midway Inlet....................	1280 *b*	1-20,000	O. H. Tittmann...........	1872.
Do............	From Midway Inlet to North Inlet...	1280 *a*	1-20,000	.....do....................	1872.
Do............	Winyah Bay and vicinity...........................	1276	1-20,000	W. H. Dennis............	1872.
Do............	Winyah Bay, entrance to Georgetown...............	834	1-20,000	H. L. Whiting and C. Rockwell.	1857-58.
Do............	Winyah Bay, entrance..............................	527	1-10,000	S. A. Wainwright and H. L. Whiting.	1853-57.
Do............	Winyah Bay, from Marsh Islands to Georgetown.....	526	1-20,000	.....do....................	1853-57.
Do............	Part of the Santee river and vicinity..................	1308	1-20,000	W. H. Dennis............	1873.
Do............	Vicinity of Cape Romain............................	1347	1-20,000	.....do....................	1874.
Do............	Vicinity of Bulls Bay and Bacon Key................	772	1-20,000	W. S. Edwards...........	1857.
Do............	Bulls Bay and vicinity..............................	1400 *a*	1-20,000	W. H. Dennis............	1875.
Do............	Bulls Bay to Breach Inlet...........................	1400 *b*	1-20,000	.....do....................	1875.
Do............	From Princes Inlet to Dewees Inlet..................	681	1-20,000	J. N. Maffitt..............	1856-57.
Do............	Long Island, from Breach Inlet to Dewees Inlet.. ...	471	1-20,000	R. M. Bache..............	1854.
	Charleston to Savannah.				
South Carolina....	North side of Charleston Harbor.....................	262	1-10,000	S. A. Gilbert and W. S. Edwards.	1849-58.
Do............	South side of Charleston Harbor, including city of Charleston.	261	1-10,000	S. A. Gilbert..............	1849.
Do............	Vicinity of Morris Island and Fort Sumter...........	715	1-10,000	J. Seib....................	1858.
Do............	Charleston and vicinity.........	710	1-10,000	W. S. Edwards...........	1857-58.
Do............	Cooper and Ashley rivers...........................	1975	1-10,000	F. D. Granger............	1890.
Do............	Confluence of the Cooper and Wando rivers..........	2162	1-10,000	W. C. Hodgkins..........	1894.
Do............	.....do..	2163	1-10,000	J. W. Donn...............	1894.
Do............	.....do..........................	2168	1-10,000	C. H. Boyd...............	1894.
Do............	Ashley and Cooper rivers...........................	2167	1-10,000	.....do....................	1894.
Do............	Ashley River, from Bull Creek to Lambs.......	2166	1-10,000	.....do....................	1894.
Do....	Ashley River..	2165	1-10,000	J. W. Donn...............	1894-95.
Do............	Ashley and Cooper rivers...........................	2164	1-10,000	.....do....................	1894.
Do............	Vicinity of Wappoo Creek and parts of Jones and Johns islands.	1604 *a*	1-20,000	C. T. Iardella.............	1876.
Do............	Vicinity of Wappoo Creek	1604 *b*	1-10,000	.....do....................	1879.
Do............	Morris and Folly islands............................	964	1-10,000	W. H. Dennis............	1864.
Do............	Folly Island, from Light-House Inlet westward......	296	1-20,000	S. A. Gilbert..............	1849.
Do............	From Light-House Inlet to Stono Inlet..............	714	1-20,000	J. Seib....................	1858.
Do............	Stono Inlet..	899	1-20,000 1-5,000	C. Rockwell..............	1862.
Do............	Mouth of Savannah River to May River (hydrographic).	803	1-20,000	.....do....................	1859-60.
Do............	Kiawah River and Island and west end of Folly Island.	491	1-20,000	R. M. Bache..............	1854.
Do............	Eastern shore of North Edisto River and vicinity....	322	1-20,000	G. D. Wise................	1851.
Do............	Wadmelaw and Stono rivers (hydrographic)........	1639	1-20,000	G. C. Hanus, U. S. N.......	1885.
Do............	Western shore of North Edisto River and vicinity...	327	1-20,000	G. D. Wise................	1851.
Do............	Vicinity of South Edisto River.......................	508	1-20,000	J. Seib....................	1852.
Do............	Jehossee Island and upper part of Edisto Island.....	679	1-20,000	.....do...........	1856-57.
Do............	Vicinity of St. Helena Sound........................	611	1-20,000	J. Seib, W. H. Dennis, and C. Junken.	1856-59-67-75.
Do............	Northern end of Hunting Island (supplemental)....	611	1-10,000	J. F. Moser..............	1876.
Do............	Coosaw River to Ashepoo River, including part of Ladys Island.	1307 *b*	1-20,000	C. Hosmer................	1872-73.
Do............	Bull and Combahee rivers (hydrographic)...........	1084	1-10,000 1-20,000	C. Hosmer and J. N. McClintock.	1871.
Do............	Coosaw River and vicinity..........................	996	1-20,000	W. H. Dennis............	1865-67.
Do............	Fripps Inlet to Port Royal Sound....................	840	1-20,000	J. Seib, C. Rockwell, and W. H. Dennis.	1859-67.
Do............	St. Helena and Ladys islands.......................	1275	1-20,000	C. Hosmer................	1871-72.
Do............	Paris Island and parts of Port Royal and Ladys islands.	1070	1-20,000	.....do....................	1868.
Do............	Vicinity of Port Royal and Beaufort	1006	1-20,000	W. H. Dennis...	1865.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Charleston to Savannah—Continued.				
South Carolina....	Beaufort and vicinity	1905	1-20,000	C. Rockwell	1863.
Do	Port Royal Island	1307 *a*	1-20,000	C. Hosmer	1872-73.
Do	Head of Broad River, including Whales Branch	997	1-20,000	C. O. Boutelle and R. E. Halter.	1865.
Do	Pocotaligo and vicinity (war map)	974	1-10,000	F. W. Dorr	1865.
Do	Broad River, from Paris Island to Whales Branch	998	1-20,000	C. O. Boutelle, W. H. Dennis, and R. E. Halter.	1864-65.
Do	Between Broad River and May River	1195	1-20,000	C. Hosmer	1871.
Do	Vicinity of Daw Island	839	1-20,000	J. Seib and C. Rockwell	1859.
Do	Eastern end of Hilton Head Island and part of Paris Island.	809	1-20,000	C. Rockwell	1859-60.
Do	Vicinity of Port Royal and Beaufort	1006	1-20,000	W. H. Dennis	1865.
Do	Mouth of Savannah River to May River	803	1-20,000	C. Rockwell	1859-60.
Do	Savannah River to Cooper River, west of Danfuskie Island.	1196	1-20,000	C. Hosmer	1870-71.
	Savannah River to St. Johns River.				
Georgia	Savannah River entrance	1349	1-5,000	C. Hosmer	1874.
Georgia and South Carolina.	Savannah River, from Fort Pulaski northward, including Elba Island.	379	1-10,000	H. L. Whiting	1852.
Do	Savannah River, vicinity of Long and Bird islands	1348 *b*	1-5,000	C. Hosmer	1874.
Do	Savannah River, vicinity of Elba Island	1348 *a*	1-5,000	....do	1874.
Do	Savannah River, from Elba Island to Savannah	383	1-5,000	H. L. Whiting	1852.
South Carolina....	Shore line, Savannah River, vicinity of Savannah	343	1-10,000	....do	1852.
Georgia	Savannah River, vicinity of Forts Jackson and Lee and Batteries Tatnell and Barnwell.	1027	1-5,000	C. O. Boutelle	1866.
South Carolina and Georgia.	Savannah River, from Savannah to Cross Tides, including city of Savannah.	385	1-10,000	H. L. Whiting	1852.
Do	Savannah River, from Cross Tides to head of Isla Island.	380	1-10,000	....do	1852.
Georgia	Wilmington River and vicinity	992	1-20,000	C. Fendall	1865-67.
Do	Wassaw Sound and vicinity	906	1-20,000	W. H. Dennis	1863.
Do	Ossibaw Sound and vicinity	706	1-10,000	A. M. Harrison, C. Ferguson, and W. H. Dennis.	1858.
Do	Vicinity of Romerly Marsh Creek	1089	1-20,000	C. Hosmer	1869.
Georgia	Vicinity of Ogeechee and Vernon rivers	707	1-10,000	A. M. Harrison, C. Ferguson, and W. H. Dennis.	1858.
Do	Topography of vicinity of fortifications of rivers emptying into Ossibaw Sound.	991	1-20,000	C. Fendall	1865.
South Carolina....	Map, vicinity of Savannah (war map)	972	¾ in. to 1 m.	W. H. Dennis	1865.
Georgia	Between Ossibaw and St. Catherines Sound	841	1-20,000	H. S. Du Val	1858-59-60.
Do	Ogeechee to Medway River, west of Florida Passage	1109	1-20,000	C. Hosmer and H. G. Ogden.	1869.
Do	Northern part of St. Catherines Island and vicinity	1060	1-20,000	C. Rockwell and J. A. Sullivan.	1867.
Do	From Medway River to Julienton River	1155	1-20,000	C. Hosmer and H. G. Ogden.	1869.
Do	Sapelo Sound and adjacent waters	721	1-20,000	A. W. Longfellow	1857-58.
Do	Doboy Sound and vicinity	1080	1-20,000	W. H. Dennis	1868.
Do	Topographical reconnoissance of Sapelo Island	678	1-10,000	H. S. Du Val	1857.
Do	Altamaha Sound and vicinity	1114	1-20,000	W. H. Dennis	1869.
Do	City of Darien and vicinity	1114 *bis*	1-20,000	....do	1869.
Do	St. Simons Island, Long Island, and part of Little St. Simons Island.	1108	1-20,000	C. T. Iardella	1869.
Do	Vicinity of Mackays and Back River	1113	1-20,000	W. H. Dennis	1869.
Do	St. Simons Sound	750	1-10,000	A. W. Longfellow and C. Fendall.	1856-57.
Do	Blythe Island and Brunswick Harbor	778	1-10,000	....do	1856-58.
Do	St. Andrews and Jekyl sounds	1145	1-20,000	C. Rockwell, J. A. Sullivan, and C. M. Bache.	1867-68-70.
Do	Part of Cumberland Island and vicinity	1152	1-20,000	W. H. Dennis	1870.
Do	Reconnaissance for proposed base line, Cumberland Island.	624	1-10,000	A. M. Harrison and W. H. Dennis.	1857.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Savannah River to St. Johns River—Continued.				
Georgia and Florida.	Fernandina Harbor and vicinity	613	1-10,000	A. M. Harrison and W. H. Dennis.	1857.
Do	St. Marys and vicinity	614	1-10,000	do	1857.
Florida	Nassau Sound and vicinity	1232 *a*	1-20,000	W. H. Dennis	1871.
Do	Part of Amelia River and vicinity	615	1-10,000	A. M. Harrison and W. H. Dennis.	1857.
	St. Johns River to Cape Canaveral.				
Florida	The mouths of St. Johns River and Fort George Inlet.	411	1-10,000 / 1-5,000	R. M. Bache	1853.
Do	St. Johns River entrance	965	1-10,000	W. H. Dennis	1864.
Do	Sisters Creek and vicinity	1232 *b*	1-20,000	do	1871.
Do	St. Johns River, from light-house to Browns Creek	550	1-10,000	A. M. Harrison	1855.
Do	St. Johns River, from Browns Creek to Point Suarrez.	551	1-10,000	do	1855.
Do	St. Johns River, from Point Suarrez to Jacksonville	552	1-10,000	A. M. Harrison and P. R. Hawley.	1855-56.
Do	Vicinity of Jacksonville	963	1-10,000	W. H. Dennis	1864.
Do	Triangulation and topography east of Jacksonville, vicinity of New River.	765	1-69,000 (approx.)	M. L. Smith, J. S. Bradford, and W. J. Gerdner.	1859.
Do	St. Johns River, Jacksonville to Mandarin Point	1459 *a*	1-20,000	H. G. Ogden, W. I. Vinal, and C. A. Ives.	1876-77.
Do	St. Johns River, Mandarin Point to San Patricio Point.	1459 *b*	1-20,000	H. G. Ogden and C. A. Ives.	1877.
Do	St. Johns River, Christophers Point to Buckleys Bluff and Doctors Lake.	1459 *c*	1-20,000	do	1876-77.
Do	St. Johns River, San Patricio Point to Raceys Point.	1465	1-20,000	F. W. Perkins	1878.
Do	St. Johns River, from Raceys Point to Cedar Point	1564 *a*	1-20,000	E. Ellicott	1884-85.
Do	St. Johns River, from Cedar Point to San Mateo	1564 *b*	1-20,000	do	1884-85.
Do	Reconnaissance of St. Johns River, Jacksonville, to Lake Monroe.	2027	1-80,000	H. G. Ogden	1875.
Do	Reconnaissance of St. Johns River	1512	1-80,000	E. Ellicott	1883.
Do	Seacoast south of St. Johns River (first sheet)	712	1-10,000	J. Mechan	1858.
Do	Seacoast south of St. Johns River (second sheet)	713	1-10,000	do	1858.
Do	Vicinity of Diego Plains	822	1-20,000	F. W. Dorr	1861.
Do	Part of North and Guano rivers	784	1-20,000	do	1860-61.
Do	St. Augustine and vicinity	783	1-10,000	do	1859-60.
Do	From Matanzas Inlet north	1082	1-20,000	C. M. Bache	1867.
Do	Matanzas River and vicinity	1268	1-20,000	A. M. Harrison	1872.
Do	Head of Halifax River and vicinity	1298	1-20,000	do	1873.
Do	Part of Halifax River	1343	1-20,000	do	1874.
Do	Mosquito Inlet and vicinity	1344	1-20,000	do	1874.
Do	Mosquito Inlet and vicinity (supplement)	1344	1-10,000	do	1874.
Do	Mosquito Lagoon and head of Indian River	1415 *a*	1-10,000	C. Hosmer	1875.
Do	Vicinity of Haulover Canal	1415 *b*	1-5,000	do	1875.
Do	Part of Mosquito Lagoon, head of Banana River and part of Banana Creek.	1423	1-20,000	do	1874-75.
Do	Indian River, vicinity of Titusville, with part of Banana Creek.	1422	1-20,000	do	1875-76.
Do	Vicinity of Cape Canaveral and Banana River	1450 *a*	1-20,000	C. Hosmer and J. Hergesheimer.	1876-77.
Do	Vicinity of Cape Canaveral	300	1-20,000	H. Adams	1850.
Do	Indian River, from Addison Point to Oleander Point.	1435	1-20,000	C. Hosmer	1876.
	Cape Canaveral to Cape Sable, including Florida Keys.				
Florida	Indian River, from Oleander Point to Eau Gallie and part of Newfound Harbor and Banana River.	1450 *b*	1-20,000	C. Hosmer and J. Hergesheimer.	1876-77.
Do	Indian River, from Banana River to Rock Point	1460	1-20,000	R. M. Bache and C. A. Ives.	1878.
Do	Indian River, from Goat Creek to Sebastian River	1478	1-20,000	W. I. Vinal and W. C. Hodgkins.	1879.
Do	Indian River, from Sebastian Creek to the Narrows	1544	1-20,000	W. I. Vinal	1880-81.
Do	Indian River, from the Narrows to the Inlet	1630	1-20,000	C. H. Boyd	1882.
Do	Vicinity of Indian River Inlet	785	1-10,000	C. Ferguson, H. Anderson, and J. S. Bradford.	1860-61.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Cape Canaveral to Cape Sable, including Florida Keys—Continued.				
Florida	Indian River, from the inlet southward	1650	1-20,000	B. A. Colonna	1883.
Do	Indian River, including St. Lucie River, Manatee Creek, and part of Jupiter Narrows.	1652	1-20,000	do	1883.
Do	Jupiter Narrows, Hobes Sound, Jupiter Sound, and Jupiter River.	1640	1-20,000	do	1883.
Do	Vicinity of Lake Worth	1649	1-40,000	do	1883.
Do	Between south end of Lake Worth and Hillsboro Inlet.	1657	1-40,000	do	1884.
Do	Between Hillsboro and New River Inlets	1656	1-40,000	do	1884.
Do	New River Inlet to Biscayne Bay	1510	1-20,000	O. H. Tittmann	1883.
Do	Biscayne Key, from Norris Cut north	1049	1-20,000	C. T. Iardella	1867.
Do	Biscayne Bay, from Shoal Point to Miami, including Key Biscayne.	336	1-20,000	H. Adams	1851.
Do	Soldier Key, Ragged Keys, and part of Elliotts Key.	409	1-20,000	do	1852-53.
Do	Western coast of Biscayne Bay, from Shoal Point to Black Point.	744	1-20,000	C. T. Iardella	1859.
Do	Elliotts Key, Cæsars Creek, and Old Rhodes Key	408	1-20,000	H. Adams	1853.
Do	Western coast of Biscayne Bay, from Turtle Point to Fender Point.	745	1-20,000	C. T. Iardella	1859.
Do	Northern part of Key Largo	573	1-20,000	S. A. Wainwright and H. S. Du Val.	1854-55.
Do	Cards Sound, from Arsenicker Keys southward	746	1-20,000	C. T. Iardella	1859.
Do	Southern part of Cards Sound	747	1-20,000	do	1859.
Do	Barnes Sound and vicinity (topography and hydrography).	1154	1-40,000	J. G. Oltmans.	1870.
Do	South shore of Key Largo, from Point Charles northward.	574	1-20,000	S. A. Wainwright and C. Fendall.	1855.
Do	Topography south of Black Water Bay	758	1-20,000	C. T. Iardella	1859.
Do	Barnes Sound north of Point Charles	857	1-20,000	do	1860.
Do	Florida Keys, from Point Charles to Lower Matecumbe Key.	640	1-20,000	S. A. Wainwright	1857.
Do	Florida Keys, north shore of Long Key and vicinity	690	1-20,000	F. W. Dorr	1857.
Do	North shores of Upper Matecumbe Key and Windleys Island.	696	1-20,000	C. T. Iardella	1858.
Do	South shore of Lower Matecumbe Key, including Lignum Vitæ Key.	641	1-20,000	S. A. Wainwright	1857.
Do	Barnes Sound and vicinity (topography and hydrography.)	1071	1-30,000	C. T. Iardella	1868.
Do	North shores of Long and Lower Matecumbe keys	694	1-20,000	do	1858.
Do	Buchanan Keys, Rabbit Key, and adjacent keys	748	1-20,000	do	1859.
Do	Oyster Keys and adjacent keys	749	1-20,000	do	1859.
Do	Vicinity of Cape Sable, from Palm Point to upper crossing.	649	1-20,000	F. W. Dorr	1857.
Do	Florida Keys, Long Key to Duck Key	688	1-20,000	do	1857.
Do	Florida Keys, vicinity of Fat Deer, Crawl, and Grassy keys.	689	1-20,000	do	1857.
Do	Vicinity of Vaca Keys	651	1-20,000	do	1857.
Do	From Knights Key and Sombrero Key to Bahia Honda.	339	1-20,000	H. Adams	1851.
Do	Little Pine, Johnson, Flat, and other keys	627	1-20,000	C. T. Iardella	1857.
Do	Big Pine, No Name, Ramrod, Torch, and other keys	625	1-20,000	do	1857.
Do	Eastern shore of Big Pine Key and western shore of No Name Key.	461	1-20,000	S. A. Wainwright	1854.
Do	Howes, Annette, Spanish, and other keys	626	1-20,000	C. T. Iardella	1857.
Do	Content, Water, Raccoon, Knock 'em Down, Burnt, Torch, and Howes keys.	652	1-20,000	F. W. Dorr	1857.
Do	Sugar Loaf, Cudjo, Summerland, and Loggerhead keys.	568	1-20,000	C. T. Iardella	1856.
Do	Johnstons, Sawyers, and adjacent keys	560	1-20,000	S. A. Wainwight	1856.
Do	Snipe Keys and Saddle Bunch Keys	494	1-20,000	H. Adams	1855.
Do	Keys north and east of Boca Chico	457	1-20,000	do	1853-54.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Cape Canaveral to Cape Sable, including Florida Keys—Continued.				
Florida	Mud Keys	493	1-20,000	H. Adams	1855.
Do.	Boca Chico and adjacent keys	417	1-10,000	R. M. Bache	1853.
Do	Key West, Stock Island, and adjacent keys	291	1-10,000	H. Adams	1850.
Do	Outer keys and ledges lying southwest of the harbor of Key West.	301	1-10,000	.....do	1850. (?)
Do	Outer keys north and west of the harbor of Key West.	302	1-20,000	.....do	1850.
Do	Marquesas, Boca Grande, and adjacent keys eastward.	319	1-20,000	.....do	1851.
Do	The Dry Tortugas (and supplement)	1410	1-10,000	H. G. Ogden	1875.
	From Cape Sable to Tampa Bay.				
Florida	Cape Sable to Northwest Cape	1930	1-20,000	J. Hergesheimer	1889.
Do	From Palm Point to Northwest Cape	650	1-20,000	F. W. Dorr	1857.
Do	Northwest Cape to Shark Point	1903	1-20,000	J. Hergesheimer	1889.
Do	Shark Point to Porpoise Point	1904	1-20,000	.....do	1889.
Do	Porpoise Point to Rabbit Key	1837	1-20,000	.....do	1888.
Do	Horse Key to Rabbit Key	1836	1-20,000	.....do	1888.
Do	Cape Romano to Horse Key	1835	1-20,000	.....do	1888.
Do	Big Marco Pass to Cape Romano	1553 *a*	1-20,000	.....do	1885.
Do	Coximbas Bay	2004	1-10,000	.....do	1890.
Do	Johns Pass to Big Marco Pass	1553 *b*	1-20,000	.....do	1885.
Do	Inside passage back of Cape Romano	2005	1-10,000	.....do	1890.
Do	Wiggins Pass to Johns Pass	1554 *a*	1-20,000	.....do	1885.
Do	Bowditch Point to Wiggins Pass	1554 *b*	1-20,000	.....do	1885.
Do	San Carlos Bay and approaches	693	1-20,000	F. W. Dorr	1858.
Do	Caloosahatchee River, from entrance to Nigger Head	2126	1-10,000	J. Hergesheimer	1892.
Do	Caloosahatchee River, from Nigger Head to Hancock Creek.	2122	1-10,000	J. Hergesheimer and W. I. Vinal.	1892-93.
Do	Caloosahatchee River, from Hancock Creek to Beautiful Island.	2123	1-10,000	.....do	1892-93.
Do	Captiva Pass to Sanibel Island, including part of Pine Island.	739	1-20,000	F. W. Dorr and C. Ferguson.	1859.
Do	South shore of Charlotte Harbor entrance	738	1-20,000	.....do	1859.
Do	Vicinity of Matlacha Pass	1048	1-20,000	C. T. Iardella	1866-67.
Do	Boco Grande entrance to Boco Nueva Pass	853	1-20,000	.....do	1860.
Do	Charlotte Harbor, vicinity of Cape Haze and opposite shore.	854	1-20,000	.....do	1860.
Do	Charlotte Harbor, from Key Point to mouth of Peas Creek.	855	1-20,000	.....do	1860.
Do	Peas Creek, head of Charlotte Harbor	856	1-20,000	.....do	1860.
Do	Lemon Bay, from Bocilla Pass to Stump Pass	1518 *b*	1-20,000	J. Hergesheimer	1883.
Do	Lemon Bay, from Stump Pass to Roberts Bay	1518 *a*	1-20,000	.....do	1883.
Do	Little Sarasota Bay and vicinity	1517 *b*	1-20,000	.....do	1883.
Do	Big Sarasota Pass to Caseys Pass	1647	1-20,000	.....do	1883.
Do	Sarasota Bay and vicinity	1517 *a*	1-20,000	.....do	1883.
Do	Eastern shore of Sarasota Bay	1653	1-20,000	.....do	1883.
	Tampa Bay to Pensacola Bay.				
Florida	South shore of Tampa Bay, Palmasola Point to Piney Point.	1346 *b*	1-20,000	H. G. Ogden	1874.
Do	South shore of Tampa Bay, Piney Point to Mangrove Point.	1408 *b*	1-20,000	.....do	1875.
Do	Ballast Point to Mangrove Point	1411 *a*	1-20,000	J. Hergesheimer	1875.
Do	Ballast Point to Tampa	1411 *b*	1-20,000	.....do	1875.
Do	Head of Old Tampa Bay	1409 *b*	1-20,000	H. G. Ogden	1875.
Do	Old Tampa Bay, from Smack Bayou to Rocky Point	1409 *a*	1-20,000	.....do	1875.
Do	North shore of Tampa Bay, Point Pinelos to Gadsdens Point.	1408 *a*	1-20,000	.....do	1875.
Do	Mullet, Egmont, and Passage Keys, and north end of Palm Key.	1316 *b*	1-20,000	Andrew Braid	1873.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Tampa Bay to Pensacola Bay—Continued.				
Florida	Boca Ceiga Bay	1316 *a*	1-20,000	Andrew Braid	1873.
Do	Head of Boca Ceiga Bay	1301 *b*	1-20,000	H. G. Ogden	1873.
Do	Clearwater Harbor	1301 *a*	1-20,000	.....do	1873.
Do	Clearwater Harbor, entrance to Anclote Keys	1698	1-20,000	W. I. Vinal	1884.
Do	Trouble Creek to Cedar Point	1699	1-20,000	.....do	1886.
Do	Cedar Point to Wall Creek	1700	1-20,000	.....do	1886.
Do	Vicinity of Bay Port	962	1-20,000	N. S. Finney	1860. (?)
Do	Raccoon Point to Chesshowitzka Bay	782	1-20,000	.....do	1859.
Do	From Homosassa River southward	781	1-20,000	.....do	1860.
Do	Green Point to Homosassa River	779	1-20,000	.....do	1858-59.
Do	Homosassa River	691	1-10,000	.....do	1858.
Do	Crystal Bay and vicinity	705	1-20,000	.....do	1858.
Do	Vicinity of Withlacoochee River	780	1-20,000	.....do	1859.
Do	Mouth of Withlacoochee River (reconnaissance)	570	1-10,000	A. M. Harrison	1856.
Do	From Wiccasassa River to Withlacoochee Bay	699	1-20,000	N. S. Finney	1858.
Do	Wiccasassa Reefs	571	1-10,000	A. M. Harrison	1856.
Do	Mouth of Wiccasassa River (reconnaissance)	569	1-10,000	.....do	1856.
Do	From Cedar Keys eastward	572	1-10,000	.....do	1856.
Do	Vicinity of Cedar Keys	423	1-10,000	F. H. Gerdes	1852-54.
Do	Keys south of Cedar Keys	422	1-10,000	.....do	1852.
Do	California Creek to Grassy Key	1426 *b*	1-20,000	F. W. Perkins	1876-77.
Do	Peppermint Keys to California Creek	1426 *a*	1-20,000	.....do	1876.
Do	From Dallas Creek to Live Oak Point	1425 *a*	1-20,000	.....do	1875.
Do	Peppermint Keys to Steinhatchee River	1425 *b*	1-20,000	.....do	1875.
Do	From Live Oak Point to Fenholloway River	1424 *b*	1-20,000	.....do	1875.
Do	From Fenholloway River to Ocilla River	1424 *a*	1-20,000	.....do	1875.
Do	Ocilla River	454	1-20,000	G. D. Wise	1854.
Do	From St. Marks River to Ocilla River	819	1-20,000	.....do	1859-60.
Do	St. Marks River	575	1-20,000	.....do	1856.
Do	Ocklockonnee Bay to St. Marks River	820	1-20,000	.....do	1859-60.
Do	Ocklockonnee Bay	771	1-20,000	.....do	1859.
Do	Alligator Harbor and eastern part of St. Georges Sound.	695	1-20,000	C. T. Iardella	1858.
Do	Vicinity of Carrabee River and Dog Island	697	1-20,000	.....do	1858.
Do	Crooked River, with topography (hydrographic)	1390	1-20,000	J. Hergesheimer	1878.
Do	Appalachicola Bay and St. Georges Sound, from Appalachicola to East Pass.	647	1-20,000	G. D. Wise	1856-57.
Do	Vicinity of East Bay, Appalachicola Bay	648	1-20,000	.....do	1857.
Do	Mouth of Appalachicola River (with hydrography)	601	1-20,000	.....do	1857.
Do	Appalachicola Bay, entrance West Pass to Cedar Point	646	1-20,000	.....do	1857.
Do	St. Vincent Sound and Island	698	1-20,000	.....do	1858.
Do	St. Josephs Bay, Cape San Blas and vicinity	1065	1-20,000	S. C. McCorkle	1868.
Do	St. Josephs Point to St. Andrews Point	1091	1-20,000	H. M. De Wees	1869.
Do	St. Andrews Bay and Sound	477	1-20,000	G. D. Wise	1855.
Do	East Bay, a tributary of St. Andrews Bay	1147 *b*	1-20,000	C. T. Iardella	1870-71.
Do	Detached topography, St. Andrews East and West Bays.	1146	1-20,000	.....do	1870.
Do	North Bay, a tributary of St. Andrews Bay	1147 *a*	1-20,000	.....do	1870-71.
Do	From Philips Inlet eastward	1358 *a*	1-20,000	F. W. Perkins	1872.
Do	Vicinity of West Bay, a tributary of St. Andrews Bay	1187	1-20,000	S. C. McCorkle	1871.
Do	Blue Mountain to Phillips Inlet	1358 *b*	1-20,000	F. W. Perkins	1872.
Do	From Blue Mountain westward	1358 *c*	1-20,000	.....do	1872.
Do	Eastern part of Choctawhatchee Bay	1270	1-20,000	H. G. Ogden	1872.
Do	Western part of Choctawhatchee Bay	1269	1-20,000	.....do	1872.
Do	From East Pass eastward	1587	1-20,000	.....do	1872.
Do	East Pass to eastern part of Santa Rosa Sound	1191	1-20,000	.....do	1871.
Do	Santa Rosa Sound, from the Narrows eastward	1192	1-20,000	.....do	1871.
Do	Santa Rosa Sound, westward of Live Oak Plantation	1193	1-20,000	.....do	1871.
Do	Western part of Santa Rosa Sound, Deer Point to Sharp Point.	701	1-10,000	F. H. Gerdes	1859.
Do	Entrance to Pensacola Bay	566	1-10,000	.....do	1856.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Pensacola Bay to and including Mobile Bay.				
Florida	Pensacola Bay, from navy-yard to Emmanuel Point, with opposite shore.	567	1-10,000	F. H. Gerdes	1856.
Do	Escambia Bay, from Emmanuel Point to Tora Point, including opposite shore.	717	1-20,000	do	1858.
Do	Vicinity of East Bay	797	1-20,000	do	1860.
Do	Part of East Bay	2160	1-10,000	P. A. Welker	1894-95.
Do	East River, tributary of East Bay	2161	1-10,000	do	1894.
Do	Part of Black Water and East bays	2158	1-10,000	do	1894.
Do	Blackwater Bay	2093	1-10,000	do	1892.
Do	Blackwater River and tributaries	2094	1-10,000	do	1892-93.
Do	Part of East and Escambia bays	2159	1-10,000	do	1894-95.
Do	Part of Escambia Bay	2157	1-10,000	do	1894.
Do	Mouth of Escambia River and vicinity	2030	1-10,000	do	1891.
Do	Head of Escambia Bay	2031	1-10,000	do	1891.
Do	Navy-yard site, Gaberonne to Devils Point, with topography (hydrographic).	1932	1-5,000	do	1889.
Do	Bayou Chico to Gaberonne, including Pensacola	1984	1-10,000	do	1890-95
Do	Bayou Grande, a tributary of Pensacola Bay	1895	1-10,000	do	1889-95.
Do	From Pensacola Bay entrance westward	700	1-20,000	F. H. Gerdes	1858.
Do	Pensacola Bay entrance	1497	1-10,000	W. H. Bronson, U. S. N	1881.
Do	Vicinity of Big Lagoon	1034	1-10,000	J. G. Oltmans	1867.
Florida and Alabama.	From Big Lagoon to Perdido entrance	*1035	1-10,000	do	1867.
Florida	Big Lagoon, a tributary of Pensacola Bay	2187	1-10,000	P. A. Welker, J. Nelson, and R. L. Faris.	1895.
Do	A portion of Pensacola Bay, vicinity of Old Navy Cove.	2188	1-10,000	do	1895.
Do	A portion of Pensacola Bay, Woolsey, and west end of Santa Rosa Island.	2189	1-10,000	do	1895.
Do	Perdido Bay, vicinity of Inerarity Point and Tar Kiln Bay.	1980	1-10,000	S. Forney and W. I. Vinal.	1890.
Florida and Alabama.	Perdido Bay, from Palmetto Creek and Tar Kiln Bayou to Lillian.	1981	1-10,000	S. Forney and C. T. Iardella.	1890-91.
Do	Perdido Bay, from Lillian to mouth of Perdido River	2034	1-10,000	S. Forney	1891.
Do	Perdido Bay, Red Bluff to Millview (hydrography)	2074	1-10,000	do	1891.
Do	Perdido River, from Perdido Bay to mouth of Blackwater River.	2035	1-10,000	do	1891.
Do	Perdido Bay, vicinity of Perdido entrance and Bay La Launch.	1979	1-10,000	S. Forney and C. T. Iardella.	1890.
Alabama	Portage Creek and Long and Cotton bayous	2036	1-10,000	S. Forney	1891.
Do	Wolf Bay and tributaries	2033	1-10,000	do	1891.
Do	Perdido entrance to Little Lagoon	1042	1-10,000	J. G. Oltmans	1867.
Do	Shore line, from Little Lagoon eastward to Alabama Point.	2088	1-20,000	J. B. Baylor and W. I. Vinal.	1892.
Do	Vicinity of Bon Secours Bay	277	1-20,000	W. E. Greenwell	1849.
Do	Shore line, from Mobile Point eastward to Little Lagoon.	2087	1-20,000	J. B. Baylor and W. I. Vinal.	1892.
Do	Entrance to Mobile Bay (and duplicate)	240	1-20,000	F. H. Gerdes	1847.
Do	Entrance to Mobile Bay	1066	1-20,000	J. G. Oltmans	1868.
Do	Mobile Bay entrance	2086	1-10,000	W. I. Vinal	1892.
Do	Bon Secours Bay, from Mullet Point to Cypress Point.	276	1-20,000	W. E. Greenwell	1849.
Do	Mobile Bay, Mullet Point to Ragged Point	286	1-20,000	do	1849.
Do	Mobile Bay, from Ragged Point to mouth of Apalachee River.	294	1-10,000	do	1849.
Do	Head of Mobile Bay, from mouth of Apalachee River to Grand Bay.	288	1-20,000	do	1850.
Do	Vicinity of Mobile	295	1-10,000	do	1850.
Do	Mobile Bay, Choctow Point to Deer River Point	287	1-20,000	do	1850.
Do	Mobile Bay, from Deer River Point to Alabama Point.	275	1-20,000	do	1849.
Do	Eastern part of Dauphin Island	406	1-10,000	do	1853.
Do	Eastern end of Dauphin Island, base line survey	326	1-10,000	F. H. Gerdes	1845-46.

*And supplement.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Mobile Bay to Mississippi River.				
Alabama	Petit Bois Island	245	1-20,000	W. E. Greenwell	1848.
Mississippi	Horn Island Pass	241	1-10,000	F. H. Gerdes	1847.
Do	Horn Island Pass (hydrography)	1666	1-20,000	J. M. Hawley, U. S. N	1886.
Do	Horn Island	274	1-20,000	W. E. Greenwell	1849.
Do	Ship Island	244	1-20,000	....do	1848.
Do	....do	407	1-10,000	....do	1853.
Alabama	Mississippi Sound, Grand Point to Grand Batture Island.	243	1-20,000	....do	1848.
Mississippi	South shore Mississippi Sound, from Grand Batture Island to West Pascagoula River.	273	1-20,000	....do	1848.
Do	Mississippi Sound, West Pascagoula River to Biloxi Bay.	323	1-20,000	....do	1851.
Do	Deer Island, Mississippi Sound	384	1-10,000	....do	1852.
Do	Harbor and Back Bay of Biloxi	324	1-10,000	....do	1851.
Do	Mississippi Sound, Mississippi City to Pitcher Point	369	1-20,000	....do	1852.
Do	Harbor of Pass Christian	325	1-10,000	....do	1851.
Do	Bay St. Louis and town of Shieldsboro	370	1-20,000	....do	1852.
Do	Grand Bayou to Pearl River, including Malheureux Island.	371	1-20,000	....do	1852.
Mississippi and Louisiana.	Pearl River Island and vicinity	633	1-20,000	R. M. Bache	1856.
Louisiana	The Rigolets	656	1-20,000	....do	1855.
Do	Passes connecting Lakes Borgne and Pontchartrain	773	1-20,000	W. S. Gilbert	1858.
Do	Lake Pontchartrain, Salt Bayou to Bonfuca Bayou	774	1-20,000	....do	1859.
Do	Lake Pontchartrain, Bonfuca Bayou to Ragged Point	796	1-20,000	M. Seaton	1860.
Do	Lake Pontchartrain, Bayou Cushon to Bayou Le Bar	799	1-20,000	....do	1860.
Do	Vicinity of Point aux Herbes	786	1-20,000	W. S. Gilbert	1859.
Do	Lake Borgne, from Proctorville to Chef Menteur Pass	629	1-20,000	....do	1857.
Do	Lake Borgne, from Point aux Marchettes to Proctorville	628	1-20,000	....do	1857.
Do	Eastern shore of Lake Borgne, Malheureux Point to Point aux Marchettes.	405	1-20,000	W. E. Greenwell	1853.
Do	South shore Mississippi Sound, Nine Mile Bayou to Isle à Pitre.	404	1-20,000	....do	1852-53.
Do	Cat Island and Isle à Pitre	242	1-20,000	....do	1848.
Do	Western shore of Chandeleur Islands, vicinity of Brush and Martins islands.	654	1-20,000	S. Harris	1857.
Do	Chandeleur Sound, south of Bay Bodreau	768	1-20,000	....do	1858-59.
Do	West side Chandeleur Sound, from Barrel Key to Point Chico.	769	1-20,000	....do	1858-59.
Do	West side Chandeleur Sound, from Morgans Harbor to Indian Mound Bay.	1198	1-20,000	C. H. Boyd	1871.
Do	West side of Breton Island Sound, from Otter Bayou to Point Comfort.	1148	1-20,000	....do	1870.
Do	West side of Breton Island Sound, from Otter Bayou to Gardners Point.	1099	1-20,000	....do	1869-70.
Do	Western shore, Breton Island Sound, from Raccoon Island to California Point.	1098*a*	1-20,000	....do	1869.
Do	Vicinity of California Point, Breton Island Sound	1098*b*	1-20,000	....do	1869.
Do	Western shore of Breton Sound, vicinity of Quarantine Bay, Hog and Battledore islands.	1096	1-20,000	....do	1868-69.
Do	Chandeleur Islands, from Chandeleur Light to Big Bayou.	548	1-20,000	J. G. Oltmans	1855.
Mississippi	North Point of Chandeleur Islands	366	1-10,000	F. H. Gerdes	1852.
Do	Freemason Keys and part of Chandeleur Islands	549	1-20,000	J. G. Oltmans	1855.
Do	Chandeleur Sound (hydrographic)	1171	1-40,000	F. D. Granger	1873.
Do	Mississippi River, from Bohemia to Poverty Point (hydrographic).	1154	1-20,000	C. H. Boyd	1872.
Do	Errol Islands, Breton Island Sound	1092	1-20,000	....do	1869.
Do	Breton Island	1097	1-20,000	....do	1869.
	Mississippi River.				
Louisiana	Vicinity of Pass à l'Outre and Northeast Pass	794	1-20,000	F. H. Gerdes	1859-60.
Do	South, Grand, and Southeast passes	1038	1-20,000	J. W. Donn	1867.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Mississippi River—Continued.				
Louisiana	Mouth of South Pass, Mississippi Delta	1386	1-4,800	H. L. Marindin	1875.
Do	Southwest Pass and portions of Southeast, West, and Gordon Island bays.	1037	1-20,000	J. W. Donn	1867.
Do	Isle au Breton Bay (hydrographic)	999	1-10,000	F. P. Webber	1869.
Do	Vicinity of Cubits Crevasse	*1412 *a*	1-4,800	Andrew Braid	1876.
Do	Vicinity of Cubits Crevasse and main pass	1412 *b*	1-10,000	H. L. Marindin	1877.
Do	Mississippi River, from Cubits Crevasse to the Forts, including Grand Bay and Bird Island Sound.	1069	1-20,000	C. H. Boyd	1868.
Do	Grand Pass to Schofield Bayou	1658	1-30,000	C. Hosmer	1884.
Do	Plan of Fort Jackson	870	1-600	F. H. Gerdes	1862.
Do	Mississippi River, from the Forts to Grand Prairie	1149	1-20,000	C. H. Boyd	1870.
Do	Mississippi River, Grand Prairie to Point à la Hache.	1197	1-20,000	....do	1871.
Do	Mississippi River, Bohemia to Poverty Point	1258 *a*	1-20,000	....do	1872.
Do	Mississippi River, Poverty Point to Jesuits Church	1258 *b*	1-20,000	....do	1872.
Do	Mississippi River, Jesuits Bend to Powder House Point.	1300	1-20,000	....do	1873.
Do	Mississippi River, New Orleans and vicinity	1403	1-20,000	C. H. Boyd and Andrew Braid.	1874-75.
Do	Vicinity of Algiers and Gretna	1404 *a*	1-10,000	C. H. Boyd	1874-75.
Do	West shore of Mississippi River, opposite New Orleans.	1404 *b*	1-20,000	....do	1874-75.
Do	Mississippi River, from Carrollton to Boutte Station	1429 *a*	1-20,000	....do	1876.
Do	Mississippi River, from Boutte Station to Bonnet-Carré Point.	1429 *b*	1-20,000	....do	1876.
Do	Mississippi River, from Belle Point to Vacherie Road.	1480 *a*	1-20,000	....do	1876-77.
Do	Mississippi River, from Vacherie Road to Brilliant Point.	1481 *a*	1-20,000	....do	1877.
Do	Mississippi River, from Brilliant Point to Point Houmas.	1481 *b*	1-20,000	....do	1877.
Do	Mississippi River, vicinity of Donaldsonville	1611	1-10,000	W. H. Dennis	1880.
Do	Mississippi River, below Baton Rouge	1613	1-10,000	C. Hosmer	1880.
Do	Vicinity of Baton Rouge	1610	1-10,000	C. H. Boyd	1880.
Do	Vicinity of West Baton Rouge	1612	1-10,000	....do	1880.
Mississippi and Louisiana.	Reconnaissance of Mississippi River, Rodney to Grand Gulf and vicinity.	1920	1-20,000	F. H. Gerdes	1864.
Do	Grand Gulf, including Federal and Confederate defenses.	937	1-5,000	....do	1864.
Mississippi and Arkansas.	Reconnaissance of approaches to Vicksburg	935	1-10,000	....do	1863.
Mississippi	Vicinity of Helena	1608	1-10,000	C. H. Boyd	1878.
Various	Reconnaissance and survey sketches of Mississippi, Red, and Tennessee rivers.	1923	Various.	F. H. Gerdes	1862-63-64.
	Mississippi River to Galveston entrance.				
Louisiana	Grand Pass to Schofield Bayou	1658	1-30,000	C. Hosmer	1884.
Do	South coast of La Rouquille Bay to Schofield Bayou	1648	1-30,000	C. H. Boyd	1883.
Do	Lower part of Barataria Bay and vicinity	1468 *a*	1-20,000	W. H. Dennis	1877.
Do	Upper part of Barataria Bay and vicinity	1468 *b*	1-20,000	....do	1877.
Do	Head of Barataria Bay	1607	1-20,000	....do	1878.
Do	Bayou Moreau to Caminada Bay	1766	1-20,000	F. W. Perkins	1887.
Do	Grand Pass, Timballier to Bayou Moreau	1765	1-20,000	....do	1887.
Do	Timballier and Caillou	1764	1-20,000	....do	1887.
Do	Vine Island and eastern part of Isle Dernière	1763	1-20,000	....do	1887.
Do	Western part of Isle Dernière	1762	1-20,000	....do	1887.
Do	....do	410	1-10,000	F. H. Gerdes	1853.
Do	Shore line of Caillou Bay	1691	1-20,000	F. W. Perkins	1886.
Do	From Oyster Bayou to Caillou Bayou	1692	1-20,000	....do	1886.
Do	From Point au Fer to near Oyster Bayou	1690	1-20,000	....do	1886.
Do	Point au Fer, Shell Reef, Atchafalaya Bay	636	1-9,660.33	F. H. Gerdes	1855.
Do	Atchafalaya Bay, Point au Fer to Turn Point	637	1-9,660.33	....do	1855.
Do	Atchafalaya Bay, Turn Point to mouth of Atchafalaya River.	638	1-9,660.33	....do	1855.
Do	Atchafalaya River, from Atchafalaya Bay to Sword Point.	1822	1-10,000	C. H. Sinclair	1888.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Mississippi River to Galveston entrance—Continued.				
Louisiana	Atchafalaya River, from Sword Point to Batemans Lake.	1823	1-10,000	C. H. Sinclair	1888.
Do	Atchafalaya River, from Batemans Lake to Morgan City.	1824	1-10,000	do	1888.
Do	Atchafalaya Bay, Atchafalaya River to Belle Isle	639	1-9,660·33	F. H. Gerdes	1855.
Do	Atchafalaya Bay, vicinity of Point Chevreuil	632	1-20,000	do	1856.
Do.	Vicinity of Cote Blanche Bay	631	1-20,000	do	1857.
Do	Eastern part of West Cote Blanche Bay	764	1-20,000	do	1859.
Do	West part of West Cote Blanche Bay	793	1-20,000	do	1860.
Do	Wicks Bay and east shore of Vermilion Bay	1687	1-20,000	F. W. Perkins	1886.
Do	North shore of Vermilion Bay, including Petite Anse Bayou and Canal.	1693	1-20,000	do	1886.
Do	Continuation of Petite Anse Bayou	1694	1-20,000	do	1886.
Do	Western part of Vermilion Bay, including Vermilion River and Schooner Bayou.	1685	1-20,000	do	1886.
Do	South and east shore of Marsh Island	1680	1-20,000	do	1886.
Do	Southwest Pass and entrance to Vermilion Bay and vicinity.	1684	1-20,000	do	1886.
Do	Chenier Le Tigre and vicinity	1686	1-30,000	do	1886.
Do	Fresh Water Bayou to Big Constance Bayou, including Pecan Island.	1688	1-30,000	do	1886.
Do.	From Big Constance Bayou westward	1689	1-30,000	do	1886.
Do	From Mermenteau River eastward	1655	1-20,000	do	1884-88.
Do	From Calcasieu Pass eastward	1654	1-20,000	do	1884-88.
Do	From longitude 93° 31′ to Calcasieu Pass	1642	1-20,000	do	1883.
Do	Between Sabine and Calcasieu passes	1644	1-20,000	do	1883.
Louisiana and Texas.	From Sabine Pass eastward	1643	1-20,000	do	1883.
Do	Sabine Lake (lower part)	1641	1-20,000	do	1883.
Do	Sabine Pass and Lake (hydrographic)	1646 *a*	1-20,000	F. H. Crosby, U. S. N.	1885.
Do	Vicinity of Sabine Pass	1356	1-20,000	J. N. McClintock	1874.
Do	East of Sabine Pass, vicinity of Round Lake	1635	1-20,000	F. W. Perkins	1882.
Do	Vicinity of Salt Bayou	1633	1-20,000	do	1882.
Do	Vicinity of East Bay Bayou	1634	1-20,000	do	1882.
Do	Vicinity of East Bay	329	1-20,000	J. M. Wampler	1851.
Do	South shore of Bolivar Peninsula	1636	1-20,000	F. W. Perkins	1882.
	Galveston Bay to the Rio Grande.				
Texas	Galveston Bay, Harbor, and City	282	1-20,000	J. M. Wampler	1850.
Do	Red Fish Bar, Galveston Bay	298	1-20,000	do	1850.
Do	Galveston Bay, Smiths Point to Turtle Bay	330	1-20,000	do	1851.
Do	Galveston Bay, vicinity San Jacinto Bay	331	1-20,000	do	1851.
Do	Galveston Bay, from Red Bluff to entrance of West Bay.	283	1-20,000	do	1850.
Do	Galveston Bay, from Smiths Point to Edwards Point (hydrographic).	324	1-20,000	T. A. Craven, U. S. N.	1852.
Do	Galveston, West Bay, and part of Galveston Island	328	1-20,000	J. M. Wampler	1851.
Do	Chocolate Bay and western part of Galveston Island.	374	1-20,000	do	1852.
Do	San Luis Pass to Brazos River	375	1-20,000	do	1852.
Do	Mouth of the Brazos River	2047	1-10,000	H. G. Ogden	1891-93.
Do	Between Brazos River and Matagorda Bay	412	1-20,000	J. S. Williams	1853.
Do	Eastern part of Matagorda Bay and Peninsula	557	1-20,000	S. A. Gilbert	1856.
Do	Matagorda Bay and Peninsula, Live Oak Bay to Matagorda.	642	1-20,000	do	1855-56-57.
Do	Matagorda Bay and Peninsula, from Matagorda to Oyster Lake.	600	1-20,000	do	1857.
Do	Matagorda Peninsula, from Pass Cavallo eastward	643	1-20,000	do	1856.
Do	Matagorda Bay, from Tres Palacios Bay to Karankawa Bay.	737	1-20,000	M. Seaton	1856.
Do	Karankawa Bay (hydrographic)	1095	1-20,000	F. D. Granger	1871.
Do	Matagorda Bay, from Karankawa Bay to Cedar Point.	645	1-20,000	S. A. Gilbert	1857-58.
Do	Eastern shore of Lavaca Bay, from Coxes Bay to Benado Creek.	742	1-20,000	M. Seaton	1858.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	Galveston Bay to the Rio Grande—Continued.				
Texas	Western shore of Lavaca Bay, from Chocolate Bay to Benado Creek.	740	1-20,000	M. Seaton	1858.
Do	Vicinity of Indianola	752	1-20,000	....do	1859.
Do	East end of Matagorda Island and shore of southwest end of Matagorda Bay.	644	1-20,000	C. Hosmer and S. A. Gilbert.	1857-59.
Do	Espiritu Santo and San Antonio bays	766	1-20,000	W. H. Dennis	1859.
Do	Reconnaissance coast of Texas, from Pass Cavallo to Aransas Pass.	720	1-50,000	S. A. Gilbert	1858.
Do	Northern part of San Antonio Bay	767	1-20,000	W. H. Dennis	1859.
Do	St. Charles Bay and part of San Antonio Bay	828	1-20,000	W. S. Gilbert	1860.
Do	Matagorda Island, from Panther Point westward	1030	1-20,000	W. H. Dennis	1859.
Do	Vicinity of Mesquite Bay and western part of St. Josephs Island.	787	1-20,000	W. S. Gilbert	1860.
Do	From Aransas Pass eastward	823	1-20,000	W. S. Gilbert and C. Hosmer.	1860-61-66.
Do	Vicinity of Aransas, Copano, and St. Charles bays	838	1-20,000	W. S. Gilbert	1861. (?)
Do	West end of Copano Bay	827	1-20,000	....do	1861.
Do	Corpus Christi Bay, vicinity of Mustang and Dagger islands.	1044	1-20,000	C. Hosmer	1867.
Do	Corpus Christi and western part of Corpus Christi Bay.	1043	1-20,000	....do	1867.
Do	Neuces Bay	1513	1-20,000	R. E. Halter	1882.
Do	Neuces Bay, vicinity of Corpus Christi	1584	1-20,000	C. Hosmer	1867.
Do	Vicinity of Corpus Christi Pass and Oso Creek	1626	1-20,000	R. E. Halter	1881-82.
Do	Laguna Madre, from Peat Island to Griffins	1628	1-20,000	....do	1881-82.
Do	Laguna Madre and entrance to Baffins Bay	1627	1-20,000	....do	1881-82.
Do	Baffins Bay and vicinity	1624	1-20,000	....do	1881.
Do	Laguna Madre, from Griffins Point to Cuba Island	1679	1-20,000	....do	1881.
Do	Laguna Madre, from latitude 26° 57′ to 27° 05′	1678	1-20,000	....do	1881.
Do	Laguna Madre, from latitude 26° 50′ to 26° 57′	1677	1-20,000	....do	1879-81.
Do	Laguna Madre, from latitude 26° 42′ to 26° 50′	1676	1-20,000	....do	1879-81.
Do	Laguna Madre, from latitude 26° 35′ to 26° 42′	1477 *b*	1-20,000	....do	1879-80.
Do	Laguna Madre, from latitude 26° 27′ to 26° 35′	1477 *a*	1-20,000	....do	1879-80.
Do	Laguna Madre, from latitude 26° 20′ to 26° 27′	1476 *b*	1-20,000	....do	1879-80.
Do	Laguna Madre, from latitude 26° 13′ to 26° 20′	1476 *a*	1-20,000	....do	1879-80.
Do	Eastern shore of Laguna Madre, from Point Isabel and Brazos Santiago northward.	1045	1-20,000	C. H. Boyd	1867.
Do	Western shore of Laguna Madre, from Point Isabel northward.	1046	1-20,000	....do	1867.
Do	Vicinity of the Rio Grande	453	1-20,000	W. E. Greenwell	1854.
	PACIFIC COAST.				
	San Diego to Point Conception.				
Mexico	Islands of Los Coronados	332	1-80,000	R. D. Cutts	1851.
California	From San Diego Bay to the boundary	365	1-10,000	A. M. Harrison	1852.
Do	San Diego Bay, from San Diego south	364	1-10,000	....do	1852.
Do	Lower part of San Diego Bay	1808	1-10,000	A. F. Rodgers	1887.
Do	San Diego Bay, entrance to San Diego	333	1-10,000	A. M. Harrison	1851.
Do	Entrance to San Diego Bay	2012	1-10,000	A. F. Rodgers	1889.
Do	Part of San Diego Bay, including city of San Diego	1807	1-10,000	....do	1887.
Do	Vicinity of False Bay	363	1-10,000	A. M. Harrison	1852.
Do	From False Bay to La Jolla	2013	1-10,000	A. F. Rodgers	1889.
Do	Valley of San Dieguito to Soledad Valley and southward.	2014	1-10,000	....do	1889.
Do	San Marcos Valley to valley of San Dieguito, including Encinitas.	1898	1-10,000	....do	1887-88.
Do	From Buena Vista Valley to San Marcos Valley, including Carlsbad.	1899	1-10,000	....do	1887-88.
Do	Vicinity of La Margarita River and Oceanside	1900	1-10,000	....do	1887-88.
Do	From Homo Cañon to Cañada Aliso, including Las Flores.	2015	1-10,000	....do	1889.
Do	San Mateo Creek to Herno Cañon	2016	1-10,000	....do	1889.
Do	From San Juan by the Sea to San Mateo Creek	1738	1-10,000	....do	1886.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	San Diego to Point Conception—Continued.				
California.........	Vicinity of San Juan Capistrano......................	1645	1-10,000	A. F. Rodgers.............	1885.
Do............	Between San Juan Capistrano and Newport Bay.....	1646	1-10,000	.....do.....................	1885.
Do............	Vicinity of Newport Bay..............................	1392	1-10,000	A. W. Chase...............	1875.
Do............	Bolsas Creek to Santa Aña River......................	1369	1-10,000	.....do.....................	1874.
Do............	New River to Bolsas Creek, including Anaheim Landing.	1345	1-10,000	.....do.....................	1873.
Do............	Wilmington to Long Branch...........................	1283	1-10,000	A. W. Chase and F. Westdahl.	1872-87.
Do............	Town sites of Long Beach and Alametos Beach.......	1792	1-10,000	G. Davidson...............	1887.
Do............	Point Fermin to San Gabriel River....................	892	1-10,000	W. M. Johnson...........	1859.
Do............	San Pedro Harbor, Wilmington Breakwater (hydrographic).	706 *b*	1-10,000	A. W. Chase............ ..	1873.
Do............	Point Fermin and Point Pedro........................	476	1-10,000	W. M. Johnson............	1854.
Do............	San Clemente Island, Santa Barbara Channel.........	1526	1-20,000	S. Forney...	1878-79.
Do............	Eastern end of Santa Catalina Island................	1606	1-20,000	.....do.....................	1878.
Do............	West end of Santa Catalina Island...................	1603	1-20,000	.....do.....................	1876-77.
Do............	Vicinity of Catalina Harbor and Isthmus Cove.......	1299 *a*	1-10,000	A. W. Chase...............	1873.
Do............	Vicinity of Catalina Harbor and Isthmus Cove........	1299 *b*	1-10,000	A. M. Harrison............	1853.
Do............	Point Fermin to Point Vincente............	1153	1-10,000	A. W. Chase	1870.
Do............	From Point Vincente northward......................	1231	1-10,000	.....do..........	1871.
Do............	Wharf and town site of Redondo Beach..............	2127	1-10,000	F. Westdahl	1893.
Do............	Vicinity of Port Ballona.............................	1432 *b*	1-20,000	A. W. Chase	1876.
Do............	Topographical sketch of proposed harbor of Port Ballona.	1791	1-10,000	G. Davidson...............	1887.
Do............	Vicinity of Santa Monica.............................	1427	1-10,000	A. W. Chase	1876.
Do............	Santa Monica (with hydrography)....................	2125	1-10,000	F. Westdahl	1893.
Do............	Point Dume to Malaga Creek and eastward..........	1432 *a*	1-20,000	A. W. Chase	1877.
Do............	Point Dume to Cañada Isique.........................	703	1-10,000	W. M. Johnson	1857.
Do............	Santa Barbara Island.................................	1180	1-10,000	A. W. Chase	1871.
Do............	San Nicholas Island, Santa Barbara Channel........	1523	1-20,000	S. Forney.................	1879.
Do............	Point Mugn to Cañada Isique.........................	702	1-10,000	W. M. Johnson	1857.
Do............	From Hueneme to Point Magu.........................	893	1-10,000	.....do.....................	1857.
Do............	From Santa Clara River to Hueneme.................	576	1-10,000	.....do.....................	1855.
Do............	San Buenaventura to Santa Clara River..............	683	1-10,000	.....do................	1855.
Do............	San Buenaventura and vicinity........................	1190	1-10,000	W. E. Greenwell	1870.
Do............	From Point Gorda to San Buenaventura..............	1189	1-10,000	.....do.....................	1870.
Do............	Sand Point to Point Gorda............................	1127	1-10,000	.....do.....................	1869.
Do......	From Santa Barbara to Sand Point....................	1128	1-10,000	.....do.....................	1869.
Do............	Santa Barbara and vicinity............................	1229	1-10,000	.....do..	1870.
Do............	.....do...	373	1-10,000	A. M. Harrison............	1852.
Do............	Survey of point near Santa Barbara for light-house site.	470	1-10,000	W. M. Johnson............	1854.
Do............	Anacopa Island and part of Santa Cruz Island........	555	1-10,000	.....do.....................	1855.
Do............	Eastern end of Santa Cruz Island.....................	1437	1-20,000	S. Forney.................	1875.
Do............	Santa Cruz Island, vicinity of Prisoners and Chinese harbors.	876	1-10,000	W. M. Johnson	1859.
Do......... ..	Western end of Santa Cruz Island....................	1436	1-20,000	S. Forney.................	1874-75.
Do............	Santa Cruz Island, from Posa Anchorage to Alamos Arch.	1003	1-10,000	W. M. Johnson	1860.
Do............	East end of Santa Rosa Island........................	1326	1-20,000	S. Forney.................	1872-73.
Do............	West end of Santa Rosa Island........................	1325	1-20,000	.....do.....................	1872-73.
Do............	San Miguel Island....................................	1242	1-20,000	.....do.....................	1871.
Do............	From Santa Barbara to Goleta Point..................	1230	1-10,000	W. E. Greenwell..........	1870.
Do............	From Goleta Point eastward to Cañada de Los Dos Pueblos.	1267	1-10,000	.....do.....................	1871.
Do............	Vicinity Cañada del Refugio and Cañada del Capitan.	1247	1-10,000	....do.....................	1871.
Do............	From Cañada Quemada to Gaviota Wharf............	1338	1-10,000	.....do.....................	1873.
Do............	From Gaviota Wharf to Little Coxo..................	1339	1-10,000	.....do.....................	1873.
Do............	Point Conception and vicinity........................	1122 *a*	1-10,000	C. Rockwell	1869.
Do............	.....do...	1122 *b*	1-30,000	.....do.....................	1869.
Do............	Vicinity of Point Conception.........................	313	1-20,000	A. M. Harrison	1850.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Point Conception to San Francisco Bay.				
California	Vicinity of Espeda Landing	1520 *a*	1-10,000	A. W. Chase	1877.
Do	Vicinity of Point Arguello	1520 *b*	1-10,000	....do	1877.
Do	From Lompoc Landing to Bear Valley	1555 *a*	1-10,000	W. E. Greenwell	1879.
Do	From Lompoc Landing to Shumans Cañon	1555 *b*	1-10,000	....do	1879.
Do	From Shumans Cañon to Santa Maria River, including Point Sal.	1595	1-10,000	....do	1879.
Do	From Point Sal southward	1055	1-5,000	....do	1867.
Do	From Santa Maria River to Arroyo Grande	1596	1-10,000	....do	1879.
Do	South Point Rock to Arroyo Grande	1393	1-10,000	L. A. Sengteller	1873-74-84.
Do	San Luis Obispo Bay	1321	1-10,000	....do	1871-72.
Do	From Point San Luis Obispo to Avila, showing wharves and railroads.	1321 *bis*	1-10,000	....do	1875-84.
Do	From Point Buchon southward	1500 *a*	1-10,000	W. E. Greenwell	1881.
Do	From Point Buchon to Moro Rock	1500 *b*	1-10,000	....do	1881.
Do	From Moro Bay to Willow Creek	1662	1-10,000	S. Forney	1883-84.
Do	From Villa Creek to Cayucas Point	1663	1-10,000	....do	1884.
Do	From Villa Creek to Santa Rosa Creek	1753	1-10,000	....do	1886.
Do	Santa Rosa Creek to San Simeon Bay	1784	1-10,000	....do	1887.
Do	San Simeon Bay and vicinity	1278	1-10,000	C. Rockwell and G. Davidson.	1871-84.
Do	Point Piedras Blancos and vicinity	1395 *a*	1-10,000	C. Rockwell	1872-73.
Do	Arroyo San Carpofora and vicinity	1395 *b*	1-10,000	....do	1874.
Do	San Carpofora Creek to Salmon Creek and westward.	1829	1-10,000	S. Forney	1887.
Do	From White Rock No. 2 northward, including Villa Cañon and Alder Creek.	1901	1-10,000	....do	1888.
Do	Villa Creek to Prewett Creek	1896	1-10,000	....do	1888.
Do	Pacific Valley northward, including Mill Creek	2076	1-10,000	A. F. Rodgers and C. Rockwell.	1890.
Do	Prewett Creek to Mill Creek	2089	1-10,000	A. F. Rodgers	1890.
Do	Rockland Landing to Lopez Point	2090	1-10,000	....do	1890.
Do	Lopez Rock northward to Dolans Cañon	2077	1-10,000	A. F. Rodgers and C. Rockwell.	1890.
Do	Partingtons Sea View Landing southward to Hot Spring Cañon.	2078	1-10,000	A. F. Rodgers	1891.
Do	Partingtons Point to Pfeiffers Point	2092	1-10,000	....do	1891.
Do	Pfeiffers Point to Point Sur	2091	1-10,000	A. F. Rodgers and . C Rockwell.	1878-91.
Do	Coopers Point to Point Sur	1525 *b*	1-10,000	A. F. Rodgers	1878.
Do	Point Sur	1599	1-2,500	C. Rockwell	1875.
Do	Point Sur to Kaslers Point	1525 *a*	1-10,000	A. F. Rodgers	1876-77.
Do	From Carmel Bay southward	1458 *b*	1-10,000	....do	1876.
Do	From Monterey Bay to Carmel Bay	1458 *a*	1-10,000	.... do	1876.
Do	Point Pinos	320	1-10,000	A. M. Harrison	1851.
Do	Monterey Harbor	357	1-10,000	R. D. Cutts and A. F. Rodgers.	1852-74.
Do	Northward from Monterey Harbor	554	1-10,000	W. M. Johnson	1854.
Do	From Salinas River southward	478	1-10,000	....do	1854.
Do	From Pajaro River to Salinas River	473	1-10,000	W. M. Johnson and A. F. Rodgers.	1854-74.
Do	From Pajaro River northward	442	1-10,000	....do	1853-74.
Do	Sanguel Cove and vicinity	443	1-10,000	A. M. Harrison, W. M. Johnson, and A. F. Rodgers.	1853-74.
Do	Santa Cruz Harbor and vicinity	444	1-10,000	....do	1853-74.
Do	From Point Año Nuevo southward	445	1-10,000	....do	1853-74.
Do	From Point Año Nuevo northward to Point Bolsa	653	1-10,000	W. M. Johnson and A. F. Rodgers.	1854-74.
Do	From Point Bolsa to Tunitas Creek	682	1-10,000	W. M. Johnson	1854.
Do	From Tunitas Creek northward to Point Miramontes.	1009	1-10,000	A. F. Rodgers	1866-74.
Do	Half Moon Bay and vicinity	993	1-10,000	W. M. Johnson, A. F. Rodgers, and G. Davidson.	1861-74-84.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Point Conception to San Francisco Bay—Continued.				
California	Pillar Point to Point San Pedro	1019	1-10,000	A. F. Rodgers and G. Davidson.	1866–84.
Do	From Point San Pedro northward	395	1-10,000	A. M. Harrison	1853.
Do	From Point Lobos southward	382	1-10,000	.....do	1852.
Do	South Farallon Island	1259	1-5,000	A. F. Rodgers	1872.
Do	The North Farallones	1831	1-5,000	G. Davidson	1886.
	San Francisco Bay surveys between 1850 and 1877.				
California	South shore of Golden Gate, from Point Lobos to San Francisco.	314	1-10,000	R. D. Cutts	1850.
Do	Vicinity of Point Lobos (revised junction of sheets)	427	1-10,000	A. F. Rodgers	1853.
Do	Revisionary, for determination of light-houses and defensive works, San Francisco entrance.	663	1-10,000	A. F. Rodgers and G. Davidson.	1857–77.
Do	Yerba Buena Island, San Francisco Bay	353	1-10,000	A. F. Rodgers	1851.
Do	City of San Francisco and vicinity	687	1-10,000	.....do	1857.
Do	City of San Francisco	398	1-10,000	R. D. Cutts and A. F. Rodgers.	1852–53.
Do	City of San Francisco and vicinity	352	1-10,000	A. F. Rodgers	1852.
Do	Outskirts of San Francisco	1059	1-10,000	.....do	1867.
Do	Interior of San Francisco Peninsula	1067	1-10,000	C. Rockwell	1867.
Do	Western shore of San Francisco Bay, vicinity of Sierra Point to Point San Bruno.	460	1-10,000	A. F. Rodgers	1854.
Do	Milbrae and vicinity, interior San Francisco Peninsula.	1068	1-10,000	C. Rockwell	1867.
Do	From Point San Mateo to Angel Creek, San Francisco.	433	1-10,000	A. F. Rodgers	1853.
Do	San Francisco Bay, from Angel Creek to Ravenswood.	664	1-10,000	.....do	1857.
Do	Redwood City and vicinity, San Francisco Bay	665	1-10,000	.....do	1857.
Do	Pulgas Base, Redwood City to Ravenswood	432	1-10,000	R. D. Cutts	1853.
Do	Head of San Francisco Bay	676	1-10,000	A. F. Rodgers	1857.
Do	San Francisco Bay, from Calaveras Point to Potrero Point.	634	1-10,000	.....do	1857.
Do	San Francisco Bay, from Coyote Hills to Thompsons Landing.	635	1-10,000	.....do	1857.
Do	San Francisco Bay, from Thompsons Landing to Alameda.	481	1-10,000	.....do	1855.
Do	San Antonio Creek and vicinity	360	1-10,000	R. D. Cutts	1852.
Do	Vicinity of Oakland and Alameda	592	1-10,000	A. F. Rogers	1856.
Do	From Oakland northward	591	1-10,000	.....do	1856.
Do	.....do	358	1-10,000	R. D. Cutts	1852.
Do	Eastern shore San Francisco Bay, from Point Potrero northward.	399	1-10,000	A. M. Harrison	1853.
Do	Point San Pablo to Penole Point	561	1-10,000	A. F. Rodgers	1856.
Do	Point Wilson to Lone Tree Point	562	1-10,000	.....do	1856.
Do	Mare Island and Straits of Karquines	316	1-10,000	R. D. Cutts	1851.
Do	Benicia and vicinity, Straits of Karquines	577	1-10,000	A. F. Rodgers	1856.
Do	Suisun Bay	1029	1-20,000	.....do	1866.
Do	Mare Island and Napa Creek	563	1-10,000	.....do	1856.
Do	Napa Creek and Napa City	777	1-10,000	.....do	1858.
Do	San Pablo Bay, from Petaluma Point to Navy-Yard Slough.	564	1-10,000	.....do	1856.
Do	Petaluma Creek, from Lakeville Landing southward	817	1-10,000	.....do	1860.
Do	Head of Petaluma Creek	818	1-10,000	.....do	1860.
Do	From Point San Pedro to Petaluma Creek	472	1-10,000	.....do	1854.
Do	From Bluff Point to San Raphael	415	1-10,000	.....do	1853.
Do	Angel Island and Bluff Point	361	1-10,000	.....do	1852.
Do	Vicinity of Fort Point, Lime Point, Point Cavallo, and Alcatraz Island.	359	1-10,000	R. D. Cutts	1852.
Do	Fort Point and Alcatraz Island, showing positions for light-houses (supplementary sketch of San Francisco Harbor from De Wolfras exploration).	338	1-10,000	...do	1851.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	San Francisco Bay surveys between 1850 and 1877—Cont'd.				
California	North shore of Golden Gate	321	1–10,000	A F. Rodgers	1850.
Do	Resurvey of San Francisco Bay, San Leandro Bay to Roberts Landing.	2195	1–10,000	....do	1895.
Do	Richardsons Bay	334	1–10,000	....do	1851.
Do	Interior of Tamalpais Peninsula	1284	1–10,000	.... do	1872.
Do	Topography of Tamalpais Mountain and Eastward Ridge.	1302	1–10,000	....do	1873.
Do	Point Bonita to Ballenas Bay	400	1–10,000	A. M. Harrison	1853.
Do	Ballenas Bay and vicinity	452	1–10,000	A. F. Rodgers	1854.
	San Francisco Bay, surveys between 1881 and 1895.				
California	Point Lobos southward and eastward, including Golden Gate Park.	1631	1–10,000	L. A. Sengteller	1882.
Do	Shore line and rocks in Golden Gate	2128	1–10,000	A. F. Rodgers	1887–92.
Do	Fort Point to Point San José	1632	1–10,000	....do	1882.
Do	Point San José to Point Avisadero, including city of San Francisco.	1629	1–10,000	....do	1882.
Do	City of San Francisco	1619	1–10,000	....do	1882.
Do	City of San Francisco, water front, wharf lines, and pierheads.	2205	1–10,000	....do	1895.
Do	Oakland and Alameda, including wharves, roads, and railroads.	1625	1–10,000	....do	1881–82.
Do	Oakland Point northward, including Berkeley and West Berkeley.	1622	1–10,000	....do	1881.
Do	San Francisco Bay, from Point San Mateo northward.	2207	1–10,000	....do	1894–95.
Do	Contra Costa shore, including wharves, roads, and railroads.	1621	1–10,000	... .do	1881.
Do	San Francisco Bay, from Hunters Point southward	2206	1–10,000	....do	1895.
Do	San Pablo Bay, Penole Point to Lone Tree Point	1697	1–10,000	....do	1886.
Do	Straits of Karquines	1696	1–10,000	....do	1886.
Do	Suisun Bay, from Bulls Head Point to Middle Point, including Pyers and Roe islands.	1803	1–10,000	G. Davidson	1886.
Do	Suisun Bay, from Middle Point to New York Slough, including Honker Bay.	1793	1–10,000	....do	1886–87.
Do	Suisun Bay, part of railroads between New York Slough and Antioch.	1804	1–10,000	....do	1887.
Do	Suisun Bay, vicinity of Sacramento and San Joaquin River.	1830	1–10,000	....do	1887.
Do	Suisun Bay, part of Montezuma Creek.	1855	1–10,000	L. A. Sengteller	1888.
Do	Suisun Bay, including Nourse Slough to Denverton	1974	1–10,000	....do	1888.
Do	Suisun Bay and part of Montezuma Creek	1893	1–10,000	....do	1888.
Do	Suisun Bay, Montezuma Creek eastward	1847	1–10,000	....do	1887–88.
Do	Suisun Bay, part of Simmons or Eads Island	1848	1–10,000	....do	1887.
Do	Suisun Bay, Suisun City southward	1973	1–10,000	....do	1888.
Do	Suisun Bay, Bridgeport southward, including parts of Cordelia, Suisun, and Montezuma creeks.	1972	1–10,000	....do	1888.
Do	Suisun Bay, from Suisun Creek southward	1892	1–10,000	....do	1888.
Do	Vicinity of Mare Island and Vallejo, San Pablo Bay	1825	1–10,000	J. S. Lawson	1886.
Do	Vicinity of Tolay and Sonoma Creeks, San Pablo Bay.	1826	1–10,000	....do	1886–87.
Do	Vicinity of Petaluma Creek, San Pablo Bay	1827	1–10,000	....do	1887.
Do	San Raphael and San Quentin	1620	1–10,000	L. A. Sengteller	1881.
Do	Head of Richardsons Bay, toward San Raphael	1616	1–10,000	....do	1881.
Do	Point Bonita to Sausalito, including part of Richardsons Bay and Angel Island.	1618	1–10,000	....do	1881.
Do	From Rocky Point eastward toward Point Bonita	1617	1–10,000	....do	1881.
Do	From Ballenas southward to Rocky Point	1614	1–10,000	.... do	1881.
Do	Topography vicinity of Mount Tamalpais	1302 *bis*	1–10,000	G. Davidson	1882.
	San Francisco Bay to Cape Blanco.				
California	Ballenas Point and vicinity	456	1–10,000	A. F. Rodgers	1854.
Do	From Ballenas Point northward	807	1–10,000	....do	1859–60.
Do	From Drakes Bay eastward	806	1–10,000	....do	1859–60.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	San Francisco Bay to Cape Blanco—Continued.				
California	Drakes Bay and Drakes Estero	805	1-10,000	A. F. Rodgers	1859-60.
Do	Point Reyes and vicinity	403	1-10,000	J. S. Lawson	1852-53.
Do	From Point Reyes northward	881	1-10,000	A. F. Rodgers	1862.
Do	Abbotts Lagoon, northward and southward	882	1-10,000	do	1862.
Do	Tomales Bay, upper part	849	1-10,000	do	1862.
Do	Head of Tomales Bay	880	1-10,000	do	1862.
Do	Sketch of Tomales Bay Station	578	1-10,000	C. B. Ellis	1856.
Do	Tomales Bay, entrance	439	1-10,000	J. S. Lawson	1853-54.
Do	From Salmon Creek to Tomales Bay, including Bodega Head.	883	1-10,000	A. F. Rodgers	1862.
Do	Salmon Creek to Duncans Landing	1430 *a*	1-20,000	L. A. Sengteller	1875-76.
Do	Duncans Landing northward, including Russian River.	1430 *b*	1-20,000	do	1875-76.
Do	Fort Ross Reef to Salt Point, including Timber Cove.	1457	1-10,000	do	1876.
Do	From Salt Point to Fishermans Bay	1497 *a*	1-10,000	do	1877-78.
Do	From Fishermans Bay to Walalla River	1497 *b*	1-10,000	do	1878-79.
Do	Walalla River to Havens Neck	1535 *a*	1-10,000	do	1879-80.
Do	Havens Neck northward to Ross Gulch	1535 *b*	1-10,000	do	1880.
Do	Point Arena northward and southward	1228	1-10,000	do	1870.
Do	Alder Creek to Bridgeport Landing	1279	1-10,000	do	1870.
Do	From Bridgeport Landing to Cuffeys Cove	1305	1-10,000	do	1871.
Do	Navarro River to Albion River	1362	1-10,000	do	1872.
Do	Little River to Point Cabrillo, including Mendocino Bay.	1363 *a*	1-10,000	do	1872-73.
Do	Point Cabrillo to Pudding Creek, including Casper Creek and Noyo River Landing.	1363 *b*	1-10,000	do	1873.
Do	From Pudding Creek to Ten Mile River	1380 *a*	1-10,000	A. F. Rodgers	1874.
Do	From Ten Mile River to Abalone Point	1380 *b*	1-10,000	do	1874.
Do	From Abalone Point to Williams Point, including Cape Vizcaino.	1322	1-10,000	do	1873.
Do	Williams Point to Big White Rock, including Ussal Creek.	1323	1-10,000	do	1873.
Do	Timber Ridge to Bear Landing	1324	1-10,000	do	1873.
Do	Bear Landing to Shelter Cove	1285	1-10,000	do	1872.
Do	Shelter Cove and northward	1236	1-10,000	do	1871.
Do	Horse Mountain Cove to Buck Creek	1237	1-10,000	do	1871.
Do	Buck Creek to Hadleys Creek	1238	1-10,000	do	1871.
Do	Frasers Creek to Cooskie Creek	1239	1-10,000	do	1871.
Do	Punta Gorda and vicinity	1240	1-10,000	do	1871.
Do	Between Cape Mendocino and Punta Gorda	1241	1-10,000	do	1871.
Do	Cape Mendocino northward to Cape Fortunas	1134	1-10,000	do	1869.
Do	Cape Fortunas northward to Centerville	1135	1-10,000	do	1869.
Do	Eel River and vicinity (and tracing)	1136 *a*	1-10,000	do	1869.
Do	Mouth of Eel River (resurvey)	1136 *b*	1-10,000	do	1869-70.
Do	Mouth of Eel River	1816	1-20,000	G. Davidson	1888.
Do	Humboldt Bay, entrance southward to Table Bluff	1137	1-10,000	A. F. Rodgers	1869.
Do	Entrance and part of Humboldt Bay	474	1-10,000	J. S. Lawson	1854.
Do	Humboldt Bay, entrance and southward	1174	1-10,000	A. F. Rodgers	1870.
Do	Humboldt Bay, vicinity of Eureka	1175	1-10,000	do	1870.
Do	Humboldt Bay, Eureka Slough to Arcata	1176	1-10,000	do	1870.
Do	From Mad River northward and southward	1177	1-10,000	do	1870.
Do	From Dows Prairie to Trinidad	1178	1-10,000	do	1870.
Do	From Trinidad Head to Rocky Point	1179	1-10,000	do	1870
Do	False Klamath to Rocky Point (reconnaissance)	1378	1-20,000	A. W. Chase	1873.
Do	Klamath River, northward to False Klamath Rock	1370	1-10,000	do	1874.
Do	False Klamath Rock to Midway Point	1248 *b*	1-10,000	do	1871.
Do	Midway Point to Cushing Creek	1248 *a*	1-10,000	do	1871.
Do	Crescent City and vicinity	741	1-10,000	J. S. Lawson	1859.
Do	Point St. George and vicinity	1132	1-10,000	A. W. Chase	1869.
Do	Vicinity of Lakes Talawa and Earl	1199	1-10,000	do	1870.
Do	Smiths River and vicinity	1216	1-10,000	do	1870.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	San Francisco Bay to Cape Blanco—Continued.				
California and Oregon.	Winchuck River to Chetko River	1227	1-10,000	A. W. Chase	1870.
Oregon	Goat Island to Barnacle River, including Cape Ferrelo.	1260	1-10,000	....do	1871.
Do	From Macks Reef southward	1317	1-10,000	....do	1872.
Do	Crooks Point to Cape Sebastian	1588	1-10,000	....do	1873.
Do	Port Orford .o Cape Sebastian (reconnaissance)	1862	1-40,000	E. F. Dickins	1888.
Do	Cape Blanco to Port Orford and southward (reconnaissance).	1133	1-20,000	A. W. Chase	1869.
Do	Port Orford and vicinity	347	1-10,000	A. M. Harrison	1851.
Do	Orford Reef	1131	1-10,000	A. W. Chase	1869.
Do	Cape Blanco and vicinity	1130	1-10,000	....do	1869.
	Cape Blanco to mouth of Columbia River.				
Oregon	Blacklock Point to Five Mile Point, including Coquille River (reconnaissance).	1813	1-40,000	E. F. Dickins	1887.
Do	Entrance to Coos Bay	846	1-10,000	J. S. Lawson	1861.
Do	Coos Bay, from entrance to North Slough	1971	1-10,000	E. F. Dickins	1889.
Do	Coos Bay, from North Slough to head of bay	1970	1-10,000	....do	1889.
Do	Coos Bay	927	1-20,000	J. S. Lawson	1863.
Do	Whisky Run to Ten Mile Creek, including Coos Bay entrance (reconnaissance).	1812	1-40,000	E. F. Dickins	1887.
Do	Between Ten Mile Creek and Coos Bay entrance	1877	1-10,000	....do	1888.
Do	Ten Mile Creek and vicinity	1876	1-10,000	....do	1888.
Do	Lake Jarvis southward	1769	1-10,000	L. A. Sengteller	1886.
Do	Umpqua River entrance and vicinity	1757	1-10,000	....do	1882-83-85.
Do	Umpqua River, vicinity of Gardiner	1768	1-10,000	....do	1885.
Do	Heceta Head southward to Umpqua River (reconnaissance).	1811	1-40,000	E. F. Dickins	1887.
Do	Alseya Bay to Heceta Head (reconnaissance)	1810	1-40,000	....do	1887.
Do	Alseya Bay to Yaquina Bay (reconnaissance)	1809	1-40,000	....do	1887.
Do	Entrance to Yaquina Bay	1086	1-10,000	A. W. Chase	1868.
Do	Yaquina River, from Yaquina City eastward	1754	1-10,000	....do	1868.
Do	From Yaquina Head to Cascade Head (reconnaissance).	1776	1-40,000	C. Rockwell	1887.
Do	From Cascade Head northward to Cape Meares (reconnaissance.	1777	1-40,000	....do	1887.
Do	Nestuggah Bay and River	1529	1-10,000	....do	1883.
Do	Cape Meares to Tillamook Bay (reconnaissance)	1778	1-40,000	....do	1887.
Do	Tillamook Bay (hydrographic)	936	1-10,000	J. Kincheloe	1866-67.
Do	From mouth of Tillamook Bay northward	1417	1-10,000	J. J. Gilbert	1875.
Do	Mouth of Nehalem River and vicinity	1416 *b*	1-10,000	....do	1875.
Do	Cape Falcon northward to Hug Cape	1416 *a*	1-10,000	....do	1875.
Do	South of Tillamook Head; vicinity of Elk Creek	1382 *a*	1-10,000	....do	1874.
Do	Tillamook Head	1382 *b*	1-10,000	....do	1874.
Do	Nekanakum Creek and vicinity	1381 *a*	1-10,000	....do	1874.
Do	Between Point Adams and Nekanakum Creek	1381 *b*	1-40,000	....do	1874.
Do	South shore of Columbia River entrance	1112	1-10,000	C. Rockwell	1868.
	Columbia River.				
Oregon and Washington.	Point Adams and Sand Island	335	1-10,000	A. M. Harrison	1851.
Do	Mouth of Columbia River	317	1-22,762	W. B. McMurtrie	1850-51.
Oregon	Columbia River, Youngs Bay to John Days River	1123	1-10,000	C. Rockwell	1868.
Do	Astoria and vicinity	1806	1-10,000	J. F. Pratt	1887.
Do	South shore of Columbia River, John Days River to Warrens Landing.	1234	1-10,000	C. Rockwell	1870.
Oregon and Washington	Columbia River, Warrens Landing to Three Tree Point.	1235	1-10,000	....do	1870.
Do	Columbia River, Three Tree Point to Puget Island	1250	1-10,000	....do	1871.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Columbia River—Continued.				
Oregon and Washington.	Columbia River, vicinity of Cathalamet and Westport, including Puget Island.	1331	1-10,000	C. Rockwell	1872.
Do	Columbia River, Puget Island to Wallaces Island	1401 *a*	1-10,000	do	1874.
Do	Columbia River, Wallaces Island to Grims Island	1401 *b*	1-10,000	do	1874.
Do	Columbia River, vicinity of Wallaces Island	1431 *b*	1-10,000	J. J. Gilbert	1876.
Do	Columbia River, Grims Island to Walkers Island	1431 *a*	1-10,000	do	1876.
Do	Columbia River, vicinity of Mount Coffin	1454	1-10,000	do	1876-77.
Do	Columbia River, Cowlitz River and vicinity	1455 *a*	1-10,000	do	1877.
Do	Columbia River, Cottonwood Island to Deer Island	1455 *b*	1-10,000	do	1877.
Do	Columbia River, from near Kalama to Columbia City.	1495	1-10,000	C. Rockwell	1879.
Do	Columbia River, Columbia City to Bachelors Island	1563	1-10,000	do	1880.
Do	Columbia River, vicinity of Bachelors Island	1542	1-10,000	do	1882.
Do	Columbia River, from Falles Landing to Haydens Island and the Willamette River to Swan Island.	1562	1-10,000	do	1884.
Do	Columbia River, from Haydens Island westward, including Vancouver.	2007	1-10,000	do	1890.
Do	Columbia River, vicinity of Government Island	2085	1-10,000	do	1891.
Oregon	Willamette River, Swan Island to Ross Island	1546	1-10,000	do	1884.
Washington	Columbia River, Grays Point to Snag Island, including Grays Bay.	1249	1-10,000	do	1870.
Do	North shore Columbia River, Chinook Point to Grays Point.	1139 *a*	1-10,000	do	1869.
Do	Scarboro Hill, near Point Ellice	1894	1-20,000	do	1889.
Do	Sandy Island and Chinook Spit	1139 *b*	1-10,000	do	1869.
Do	North shore Columbia River, Cape Disappointment to Chinook Point.	1138	1-10,000	do	1869
Do	Cape Disappointment	337	1-10,000	A. M. Harrison	1851.
	Columbia River to Strait of Juan de Fuca.				
Washington	Between Willapa Bay and Columbia River	1341 *a*	1-10,000	J. J. Gilbert	1873.
Do	Willapa Bay, from Bakers Slough northward	1341 *b*	1-10,000	do	1873.
Do	Willapa Bay, from Oysterville to Long Island	1293	1-10,000	do	1872.
Do	Leadbetter Point, entrance to Willapa Bay	1261	1-10,000	do	1871.
Do	Islands in Willapa Bay	1264	1-10,000	do	1871.
Do	Willapa Bay, vicinity of North River and Bruceport	1263	1, 10,000	do	1871.
Do	Mouth of Willapa River	1342 *b*	1-10,000	do	1873.
Do	Willapa Bay, from Palux River southward	1292	1-10,000	do	1872.
Do	Willapa Bay, from North Nemur River to Long Island.	1294	1-10,000	do	1872.
Do	Willapa Bay, from Bear River to Long Island	1342 *a*	1-10,000	do	1873.
Do	Willapa Bay entrance, Cape Shoalwater to Cedar River.	1262	1-10,000	do	1871.
Do	Grays Harbor entrance and southward to Shoalwater Bay.	1701	1-20,000	do	1886.
Do	Entrance of Grays Harbor	821	1-20,000	J. S. Lawson	1860.
Do	From Point Brown to Connor Creek	1781	1-20,000	J. F. Pratt and F. Morse	1887.
Do	From Copalis River to Wreck Creek	1782	1-20,000	do	1887.
Do	From Wreck Creek to Arch Island	1783	1-20,000	do	1887.
Do	From Arch Island to Destruction Island	1786	1-20,000	do	1887.
Do	From Destruction Island to Teahwhit Head	1787	1-20,000	do	1887.
Do	From Teahwhit Head to Cape Johnson	1788	1-20,000	do	1887.
Do	From Cape Johnson to Osette River	1789	1-20,000	do	1887.
Do	From Osette River to Cape Flattery	*1790	1-20,000	do	1887.
Do	Cape Flattery	387	1-10,000	J. S. Lawson	1852.
Do	Cape Flattery, vicinity of Nee-ah Bay	386	1-10,000	do	1852.
	Straits of Juan de Fuca to the boundary.				
Washington	Port Angeles (sheet No. 1)	2109	1-4,800	J. J. Gilbert	1892.
Do	Port Angeles (sheet No. 2)	2110	1-4,800	do	1892.

*And supplement.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Straits of Juan de Fuca to the boundary—Continued.				
Washington	New Dungeness, Straits of Juan de Fuca	539	1-10,000	J. S. Lawson	1855.
Do	Part of New Dungeness	1168	1-10,000	do	1870.
Do	Protection Island to New Dungeness	1169	1-10,000	do	1870.
Do	Washington Harbor, Straits of Juan de Fuca	1165	1-10,000	do	1870.
Do	Entrance and approaches to Port Discovery	1124	1-10,000	do	1868-69.
Do	Part of Port Discovery	1125	1-10,000	do	1868.
Do	Head of Port Discovery	1126	1-10,000	do	1869-70.
Do	Port Townsend, Admiralty Inlet	582	1-10,000	do	1856.
Do	do	581	1-10,000	do	1856.
Do	Port Townsend Harbor (sheet No. 1, topography and hydrography).	2071	1-4,800	J. J. Gilbert	1891.
Do	Port Townsend Harbor (sheet No. 2, topography and hydrography).	2072	1-4,800	do	1891.
Do	Sketch and profile of Port Townsend Base	589	1-10,000	George Davidson and J. S. Lawson.	1856.
Do	Port Townsend Bay	2079	1-10,000	J. F. Pratt	1891.
Do	Kilisut Harbor	1255	1-10,000	J. S. Lawson	1871.
Do	Oak Bay	1304	1-10,000	do	1872.
Do	Sketch of Mats Mats, Port Ludlow	540	1-10,000	do	1855.
Do	Port Ludlow, entrance to Hoods Canal	537	1-10,000	do	1855.
Do	Entrance to Hoods Canal	669	1-10,000	do	1857.
Do	Port Gamble and part of Hoods Canal	585	1-10,000	do	1856.
Do	Position of buoys at entrance to Port Gamble	671	1-10,000	do	1857.
Do	Hoods Canal, Port Gamble to Hazel Point	1556	1-20,000	J. J. Gilbert	1878.
Do	Hoods Canal, head of Daboys and Quilcine bays	1557 *a*	1-10,000	do	1883.
Do	Hoods Canal, vicinity of Daboys Bay	1557 *b*	1-10,000	do	1883.
Do	Hoods Canal, entrance to Daboys Bay	1558 *a*	1-10,000	do	1883.
Do	Hoods Canal, vicinity of Oak Head and Seabeck	1558 *b*	1-10,000	do	1884.
Do	Hoods Canal, vicinity of Quatsap Point and Woods Point.	1559 *a*	1-10,000	do	1883.
Do	Hoods Canal, Tekiu Point to Chinom Point	1559 *b*	1-10,000	do	1883-84.
Do	Hoods Canal, from Ayock Point south	1560 *a*	1-10,000	do	1884.
Do	Hoods Canal, vicinity of Annas Bay	1560 *b*	1-10,000	do	1884.
Do	Hoods Canal, vicinity of Sisters Point	1561 *a*	1-10,000	do	1884.
Do	Head of Hoods Canal	1561 *b*	1-10,000	do	1884.
Do	Cases Inlet, from its head to Heron Island, including Picking Passage.	1528	1-20,000	E. Ellicott	1879-80.
Do	From Nisqually Reach to Totten Inlet	1672	1-20,000	do	1878.
Do	Hammersleys Inlet, Puget Sound	1609	1-10,000	do	1879-80.
Do	Totten Inlet, Puget Sound	1673	1-10,000	do	1879.
Do	Eld Inlet	1675	1-10,000	do	1880.
Do	Entrance to Budds Inlet	1327 *a*	1-10,000	J. S. Lawson	1873.
Do	Head of Budds Inlet	1327 *b*	1-10,000	J. S. Lawson and J. J. Gilbert.	1873.
Do	Olympia Harbor (upper sheet)	2073	1-4,800	J. J. Gilbert	1891.
Do	Olympia Harbor (lower sheet)	2074	1-4,800	do	1891.
Do	From Nisqually Reach to Totten Inlet	1672	1-20,000	E. Ellicott	1878.
Do	From Point Defiance to Anderson Island, Puget Sound.	1671	1-20,000	do	1877-78.
Do	Carrs Inlet	1674	1-20,000	do	1878.
Do	Commencement Bay, Puget Sound	1453	1-10,000	do	1877.
Do	City and water front of Tacoma	1749	1-10,000	J. J. Gilbert	1886.
Do	From Restoration Point to Robinsons Point	1452 *a*	1-20,000	E. Ellicott	1876-77.
Do	From Robinsons Point to south end of Vashon Island, including Quartermasters Harbor.	1452 *b*	1-20,000	do	1876-77.
Do	Fauntleroy Cove, Admiralty Inlet	670	1-10,000	G. Davidson and J. S. Lawson.	1857.
Do	Port Orchard, Puget Sound	1637	1-20,000	E. Ellicott	1881.
Do	Proposed site for a navy-yard	1951	1-5,000	J. F. Pratt	1889.
Do	Proposed site for a navy-yard at Port Orchard	1941	1-5,000	do	1889.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Straits of Juan de Fuca to the boundary—Continued.				
Washington.......	Eastern part of Puget Sound Naval Station, Port Orchard (topography and hydrography).	2196	1-1,000	J. J. Gilbert...............	1895.
Do............	East shore of Bainbridge Island, Admiralty Inlet....	1303 *a*	1-10,000	J. S. Lawson..............	1872.
Do............	Murdens Cove, Admiralty Inlet....	584	1-20,000	.....do.....................	1856.
Do............	Vicinity of Duwamish Bay............................	590	1-40,000	G. Davidson..............	1856.
Do............	Duwamish Bay, Admiralty Inlet......................	1390 *b*	1-10,000	J. S. Lawson..............	1874.
Do............	Vicinity of Seattle and head of Duwamish Bay..	1406	1-10,000	.....do.....................	1875.
Do............	City and water front of Seattle........................	1750	1-10,000	J. J. Gilbert.......	1886.
Do............	Vicinity of Port Madison, Admiralty Inlet............	1087	1-10,000	J. S. Lawson..............	1868.
Do............	From Point No Point to President Point, Admiralty Inlet.	1303 *b*	1-10,000	.....do.....................	1872.
Do............	Apple Cove, Admiralty Inlet..........................	583	1-20,000	G. Davidson and J. S. Lawson.	1856.
Do............	Vicinity of Point No Point, Admiralty Inlet..........	668	1-10,000	J. S. Lawson..............	1857.
Do............	Vicinity of Shilshole Bay, Admiralty Inlet............	1064	1-10,000	.....do.....................	1867.
Do............	From Point Wells to Meadow Point, Admiralty Inlet.	1390 *a*	1-10,000	.....do.....................	1874.
Do............	Possession Sound to Edmund Point....................	1389 *b*	1-10,000	.....do.................	1872-74.
Do............	Possession Sound......................................	1389 *a*	1-10,000	.....do........	1872-74.
Do............	Possession Sound, vicinity of Point Elliott............	1552	1-20,000	J. F. Pratt................	1884.
Do............	Snohomish River.......................................	1681	1-20,000	.....do.....................	1884-85.
Do............	Possession Sound and entrance to Port Susan.........	1682	1-20,000	.....do.....................	1885.
Do............	Saratoga Passage and Holmes Harbor.................	1994	1-20,000	.....do.....................	1890.
Do............	Port Susan and Stillaguamish River...................	1755	1-20,000	.....do.....................	1886.
Do............	Saratoga Passage, Penns Cove, Oak Harbor, and Crescent Harbor.	2011	1-20,000	.....do.....................	1888.
Do............	Skagit Bay, Delta, and River..........................	2156	1-20,000	F. W. Pratt...............	1889.
Do......	Harbor of Laconner....................................	2108	1-4,800	J. J. Gilbert...............	1892.
Do............	Useless Bay, Admiralty Inlet..........................	1388 *b*	1-10,000	J. S. Lawson..............	1872-74.
Do............	From Lagoon Point to Double Bluff, Admiralty Inlet.	1388 *a*	1-10,000	.....do........	1872-74.
Do............	Admiralty Bay, Puget Sound..........................	1164	1-10,000	.....do.....................	1870.
Do............	From Point Partridge eastward.......................	1254	1-10,000	.....do.....................	1871.
Do............	From Point Partridge north, Whidbey Island.........	1253	1-10,000	.....do.....................	1871.
Do............	Smiths Island, Straits of Juan de Fuca..............	538	1-10,000	.....do.....................	1855.
Do............	.....do...	1170	1-10,000	.....do.....................	1870.
Do............	Whidbey Island, vicinity of Deception Pass..........	1252	1-10,000	.... do.................. ..	1871.
Do......	Deception Pass to Ship Harbor........................	1667	1-10,000	J. J. Gilbert...............	1885.
Do............	Thatcher Pass to Watmough Bight....................	1953	1-10,000	.....do................. ..	1889.
Do............	North end of Lopez Island............................	1955	1-10,000	.....do.....................	1889.
Do............	Part of Orcas Island, Washington Sound............	1954	1-10,000	.....do.....................	1889.
Do............	Patos, Lucia, and Matia islands, Gulf of Georgia.....	1870	1-10,000	.....do.....................	1888.
Do............	.....do...	730	1-20,000	J. S. Lawson..............	1858.
Do............	North shore of Saturna Island and Samuel Island, Gulf of Georgia.	731	1-20,000	.....do.....................	1858.
Do............	Vicinity of Active Pass, Gulf of Georgia.............	732	1-20,000	.....do.....................	1858.
Do............	Point Roberts, Gulf of Georgia.......................	1874	1-10,000	J. J. Gilbert...............	1888.
Do............	Birch Bay to boundary, Gulf of Georgia....	1873	1-10,000	.....do.....................	1888.
Do............	Vicinity of Point White Horn, Gulf of Georgia......	1872	1-10,000	.....do.....................	1888.
Do............	Vicinity of Lummi Bay, Gulf of Georgia............	1871	1-10,000	.....do.....................	1888.
Do............	Nooksack River, Bellingham Bay...	1799	1-10,000	.....do.....................	1887.
Do............	North part of Bellingham Bay........................	1798	1-10,000	.....do.....................	1887.
Do............	Bellingham Bay, Whatcom Harbor (topography and hydrography).	2069	1-5,000	.....do.....................	1891.
Do............	Lummi and Eliza islands and Point Francis..........	1797	1-10,000	.....do.....................	1887.
Do............	Northeast part of Orcas Island, from Lawrence Point to Point Thompson.	1869	1-10,000	.....do.....................	1888.
Do............	Part of Orcas and Blackeley islands, Washington Sound.	1952	1-10,000	.....do.....................	1889.
Do............	Cypress, Guernes, and Sinclair islands...............	1748	1-10,000	.....do.....................	1886.
Do............	Strawberry Bay, Cypress Island, Washington Sound.	462	1-10,000	J. S. Lawson..............	1854.
Do......	Samish Flats to Bellingham Bay, Washington Sound.	1796	1-10,000	J. J. Gilbert...............	1887.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Straits of Juan de Fuca to the boundary—Continued.				
Washington	Bellingham Bay, Fairhaven Harbor and vicinity (topography and hydrography).	2070	1-5,000	J. J. Gilbert	1891.
Do	Vicinity of Samish Bay, Washington Sound	1795	1-10,000	....do	1887.
Do	Guernes, Samish, and Vendovi islands, Washington Sound.	1794	1-10,000	....do	1887.
Do	Cypress, Guernes, and Sinclair islands	1748	1-10,000	....do	1886.
Do	Ship Harbor and Padilla Bay, Washington Sound	1746	1-10,000	....do	1886.
Do	Anacostes Harbor (sheet No. 1)	2111	1-4,800	....do	1892.
Do	Anacostes Harbor (sheet No. 2)	2112	1-4,800	....do	1892.
Do	Anacostes Harbor (sheet No. 3)	2113	1-4,800	....do	1892.
Do	Fidalgo and Padilla bays, Washington Sound	1747	1-10,000	....do	1886.
Do	Orcas and Waldron islands, Washington Sound	2192	1-10,000	....do	1894.
Do	Stuart, Spieden, and other islands, Washington Sound	2193	1-10,000	....do	1894.
Do	San Juan and Henry islands, Washington Sound	2194	1-10,000	....do	1894.
	Alaska.				
Alaska and British Columbia.	Portland Inlet and vicinity	1882	1-40,000	J. McHenry	1888.
Do	Part of Portland Inlet and Portland Canal	1883	1-40,000	....do	1888.
Do	Wales Harbor, Somerville Bay, Winter Harbor, and Fillmore Inlet.	1890	Various.	H. L. Ford and J. McHenry	1888.
Alaska	Willard Inlet	1881	Arbitrary.	J. McHenry and A. M. Beecher.	1888. (?)
Do	Hidden Inlet, Pearse Canal	1879	Arbitrary.	J. McHenry	1888. (?)
Alaska and British Columbia.	Halibut Bay and part of Portland Canal	1880	1-5,000	H. L. Ford	1888. (?)
Do	Portland Canal (middle sheet)	1884	1-40,000	J. McHenry	1888.
Do	Bear River Flats and head of Portland Canal	1878	1-20,000	H. L. Ford	1888.
Alaska	Boca de Quadra	2117	1-80,000	W. I. Moore and H. L. Ford.	1892.
Do	Vixen Bay, Boca de Quadra	2118 *b*	1-10,000	W. I. Moore and J. J. Ernsoule.	1892.
Do	Behm Canal, lower part (southeastern Alaska)	2056	1-80,000	H. B. Mansfield	1891.
Do	South end of Mary Island and western parts of Cat Island and Duke Island.	2104	1-10,000	W. P. Ray	1892.
Do	Shore line, Danger Pass, etc.	2104 *a*	1-10,000	....do	1892.
Do	Duke Harbor	2104 *b*	1-10,000	....do	1892.
Do	Morse Cove	2104 *c*	1-10,000	....do	1892.
Do	East shore Duke Island, △ Vense to △ Choskee	2104 *d*	1-10,000	....do	1892.
Do	Fitzgibbon Cove, southeastern Alaska Saks Cove, southeastern Alaska Shoalwater Pass, southeastern Alaska Smeaton Bay Anchorage, southeastern Alaska	*2062	1-10,000 1-10,000 1-20,000 1-20,000	H. B. Mansfield	1891.
Do	Rudyerd Bay, southeastern Alaska	2057	1-20,000	....do	1891.
Do	Walker Cove, southeastern Alaska	2058	1-20,000	....do	1891.
Do	Thome Arm, southeastern Alaska	2060	1-40,000	....do	1891.
Do	Carroll Inlet and George Inlet, southeastern Alaska	2059	1-40,000	....do	1891.
Do	Tea Cove, George Inlet, southeastern Alaska; Great Cove, Carroll Inlet, southeastern Alaska.	2061	1-10,000 1-10,000	....do	1891.
Do	Behm Canal (upper part), southeastern Alaska	2055	1-80,000	....do	1891.
Do	Bell Arm, Convenient Cove, and McDonald Bay, southeastern Alaska.	2063	1-20,000	....do	1891.
Do	Unuk River (topographical reconnaissance)	2141	1-40,000	E. F. Dickins	1893.
Do	Topographical reconnaissance of the Unuk River from mouth of Second Cañon to the 10 marine league limit.	2178	1-40,000	....do	1894.
Do	Stikine River (topographical reconnaissance)	2145	1-40,000	J. A. Flemer	1893.
Do	....do	2143	1-40,000	....do	1893.
Do	Etolin Harbor, Wrangell Island	2138 *a*	1-10,000	G. Davidson	1869.
Do	Stikine River, from Point Rothsay to Popoff Glacier reconnaissance).	2130	1-40,000	E. F. Dickins	1893.

*The general title of this sheet is Harbor Sheets, Behm Canal, southeast Alaska.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Alaska—Continued.				
Alaska	Stikine River, from Popoff Glacier to Big Bend	2152	1-40,000	J. E. McGrath	1893.
Do	Stikine River, from Big Bend to Ten League Post	2153	1-40,000	O. H. Tittmann	1893.
Do	Keku Strait	2116	1-80,000	W. I. Moore and H. L. Ford.	1893.
Do	Chapin Bay, Hamilton Bay, and Seclusion Harbor	2118 *a*	{1-10,000 1-20,000}	....do	1892.
Do	Saginaw Bay	2120	1-20,000	W. I. Moore and J. J. Ernsoule.	1892.
Do	Security Bay	2121	1-20,000	....do	1892.
Do	Frederick Sound and Stephens Passage	1964	1-80,000	H. B. Mansfield	1889.
Do	Wocwodski and Eliza harbors	1966	1-10,000	....do	1889.
Do	Cleveland Passage and vicinity	1968	1-10,000	....do	1889.
Do	Gambier Bay	1965	1-20,000	....do	1889.
Do	Stephens Passage and Seymour Canal	1969	1-80,000	....do	1889.
Do	Holkham Bay and Tracy Arm	1967	1-80,000	....do	1889.
Do	Lynn Canal and Stephens Passage (additions to topography).	2170	1-200,000	G. B. Harber	1894.
Do	Stephens Passage	1887	1-40,000	J. McHenry	1888.
Do	Stephens Passage and entrance to Taku Inlet	1888	1-40,000	J. D. McDonald	1888.
Do	Port Snettisham	1885	1-20,000	J. McHenry	1888.
Do	Port Snettisham and Speel River	1886	1-20,000	G. R. Slocum	1888.
Do	Slocum Inlet and parts of Whiting and Speel rivers	1891	1-20,000	J. McHenry	1888.
Do	Stephens Passage	1889	1-40,000	A. M. Beecher	1888.
Do	I-yonk-een Cove, Chatham Strait, and Linderberg Harbor, Peril Strait.	2138 *b*	1-10,000	G. Davidson	1869.
Do	Lynn Canal entrance and part of Chatham Strait	2019	1-80,000	H. B. Mansfield	1890.
Do	Lynn Canal and Taku Inlet	2017	1-80,000	....do	1890.
Do	Sketch of the Taku River (topographical) below the boundary.	2182	1-40,000	H. G. Ogden	1893.
Do	Head of Lynn Canal	2018	1-80,000	H. B. Mansfield	1890.
Do	Topographical reconnaissance of the Chilkat and Chilkoot inlets.	2179	1-40,000	E. F. Dickins	1894.
Do	Sitka Sound	2148	1-40,000	Lieut. Commander W. I. Moore, U. S. N.	1893.
Do	Sitka Harbor	2149	1-20,000	....do	1893.
Do	....do	2150	1-10,000	....do	1893.
Do	Entrance to De Monti Bay and western shore of Khantaak Island.	2124	1-20,000	J. G. Doyle	1892.
Do	St. Paul Harbor, Kadiak Island	2137	1-40,000	G. Davidson and A. T. Mosman.	1867.
Do	Porpoise Harbor, Nagai Island	2131	1-7,843	W. H. Dall	1872.
Do	Sanborn Harbor, Unalaska Island	2134	1-10,000	....do	1872.
Do	Popoff Strait and Humboldt Harbor	2133	1-10,000	....do	1872.
Do	Coal Harbor, Zachareffskaia Bay, Unga Island	2132	1-10,000	....do	1872.
Do	Ilinlink Harbor (with hydrography)	1950	1-40,000	G. Davidson and A. T. Mosman.	1867.
Do	Ilinlink Harbor, Unalaska Island	2135	1-5,000	W. H. Dall	1871-72.
Do	St. Michael	2067	1-1,000	J. H. Turner	1891.
Do	St. Michael and vicinity	2068	1-20,000	....do	1891.
Alaska and Northwest Territory.	Porcupine River from Fort Yukon eastward	2065	1-20,000	....do	1890.
Do	Porcupine River from Camp Colonna westward	2064	1-20,000	....do	1890.
Do	Camp Colonna and vicinity	2066	1-5,000	....do	1890.
Alaska	Kyska Harbor, Kyska Island	2136	1-10,000	W. H. Dall	1873.
Do	Traverse line from boundary on Forty-Mile Creek to McQuestions Post.	2202	1-40,000	J. E. McGrath	1890.
Do	Traverse line from McQuestions Post down the Yukon to Flag No. 7.	2203	1-40,000	....do	1890.
Do	Sketch showing the Fairweather Mountains and shore line from Dall △ to Cape Fairweather.	2174	1-80,000	....do	1894.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	PACIFIC COAST—continued.				
	Alaska—Continued.				
Alaska	Sketch showing shore line from Osar River to Icy Cape.	2175	1-80,000	J. E. McGrath	1894.
Do	Sketch showing Yahtse base and shore line from Yahna River to Icy Cape.	2176	1-20,000	do	1894.
Do	Topographical reconnaissance of the Unuk River from mouth of Second Cañon to the 10 marine league limit.	2178	1-40,000	E. F. Dickins	1894.
Do	Topographical reconnoissance of the Chilkat and Chilkoot inlets.	2179	1-40,000	do	1894.
Do	Taku River below the boundary (topographical sketch).	2182	1-40,000	H. G. Ogden	1893.
Do	Chatham Strait	2184	1-80,000	Lieut. Commander W. I. Moore, U. S. N.	1894.
Do	Tenakee Inlet	2185	1-40,000	do	1894.
Do	Alaska Harbors, Killisnoo and lower part of Fresh-water Bay.	2186	1-10,000 1-20,000	do	1894.
Do	Photographic reconnaissance of Chilkoot and Taiya inlets (sheets Nos. 1, 2, 3, and 4).	2199	1-80,000	J. A. Flemer	1894.
Do	Topographic reconnaissance of Chilkat River and adjoining country.	2200	1-80,000	H. P. Ritter	1894.
Do	Point Turner, Yakutat Bay	2201		J. H. Turner	1892.
Do	Head of Portland Canal and adjoining country	2209	1-40,000	P. A. Welker	1895.
	MISCELLANEOUS AND WAR MAPS.				
Massachusetts	Subplan No. 6, showing the boundary lines in tide water of a portion of the cities and towns in Essex County, Mass., as located and defined pursuant to chapter 196, acts of 1881.	1865	1-2,500	F. A. Walker, H. L. Whiting, and N. S. Shaler.	1888.
Do	Plan No. 7, showing the boundary lines in tide water of a portion of the cities and towns in Barnstable, Plymouth, Norfolk, Suffolk, and Essex counties, Mass., as located and defined pursuant to chapter 196, acts of 1881.	1866	1-80,000	do	1888.
Do	Plan No. 8, showing the boundary lines in tide water of a portion of the cities and towns in Suffolk and Essex counties, Mass., as located and defined pursuant to chapter 196, acts of 1881.	1867	1-40,000	do	1888.
Do	Plan No. 10, showing the boundary lines in tide water of a portion of the cities and towns in Essex County, Mass., as located and defined pursuant to chapter 196, acts of 1881.	1868	1-80,000	do	1888.
Do	Plan showing the boundary in tide water of the cities and towns bordering on the sea in Bristol, Dukes, Nantucket, and part of Barnstable and Plymouth counties.	1833	1-80,000	do	1887.
Do	Part of Hoosac Mountain	1589	1-10,000	C. S. Pierce	1873-74.
Pennsylvania and West Virginia.	State line between Pennsylvania and West Virginia from southwest corner of Pennsylvania to the Maryland corner.	1834	1-40,000	C. H. Sinclair and C. H. Van Orden.	1883-85.
Do	State line between Pennsylvania and West Virginia, beginning at southwest corner of Pennsylvania and running east.	1924	1-40,000	do	1883.
Pennsylvania, West Virginia, and Ohio.	Meridian boundary of West Virginia and Pennsylvania from the Ohio River to the southwest corner of Pennsylvania.	1925	1-80,000	do	1883.
Do	do	1926	1-40,000	do	1883.
Michigan	Burnt Island, Lake Huron	1832	1-1,000	C. H. Sinclair	1888.
Illinois	American Bottom base line	1817	1-5,280	J. E. McGrath	1888.
California	Round Top △ Station	1466*a*	1-10,000	G. Davidson and E. F. Dickins.	1879.
Do	Sketch showing position and approaches to Round Top △.	1466*b*	4 m. to 1 in.	do	1880.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	MISCELLANEOUS AND WAR MAPS—continued.				
California	Sketch of Mount Lola △	1466 *c*	1-20,000	G. Davidson and F. F. Dickins.	1879.
Do	Part of Table Mountain, Tuolumne County	1469	1-10,000	E. Hergesheimer	1879.
Do	Moraines of Fallen Leaf Lake	1473	1-10,000	....do	1879.
Do	Yolo base line, preliminary examination	1602	1-20,000	G. Davidson and C. Rockwell.	1876.
Do	Summit of Mount Diablo, Contra Costa County	1475	1-20,000	G. Davidson	1880.
Washington and Oregon.	The Dalles, Columbia River	1498	1-10,000	E. Hergesheimer	1880.
California, Nevada, Arizona.	Lake Tahoe, California and Nevada boundary survey (not plotted).	2151	1-10,000	C. H. Sinclair	1893.
California and Nevada.	California and Nevada boundary survey, Colorado River at latitude 35°.	2129	1-10,000	....do	1893.
California, Utah, and Nevada.	Sierra Nevada and Wahsatch mountains, diagram showing proposed connection.	2139	1-600,000	A. F. Rodgers	1878.
United States	Map of United States on Lambert's zenithal projection.	2172	1-7,000,000	A. Lindenkohl	1893-94.
Alaska	Geographic chart from Tobolsk to Cape Chukobski, made during Siberian Expedition under command of Vitus Ivanovich Bering, 1725 and 1739.	2002 *a*	....		
Do	Chart of voyage from Kamchatka to discover North America, by Captain Commanding Bering, 1741, from journal kept by Swen Waxel, lieutenant of fleet.	2002 *b*	....		
Nicaragua	Grey Town Harbor	1875	1-10,000	P. C. F. West	1865.
Virginia	Manassas Junction and vicinity, Confederate defenses.	848	1-10,000	H. L. Whiting	1862.
North Carolina	Attack on Fort Fisher	1995	1-5,000	J. S. Bradford	1865.
South Carolina	Defenses of Charleston	976	Various.	C. O. Boutelle	1865.
Tennessee	Approaches and defenses of Knoxville	939	1-10,000	C. Rockwell	1863-64.
Do	Lookout Valley north of Wauhatchee and parts of Lookout and Raccoon mountains.	966	1-10,000	J. W. Donn	1863.
North Carolina	Goldsboro west of the Wilmington and Western Railroad, including its defenses and portions of Neuse and Little rivers.	970	1-10,000	F. W. Dorr	1865.
Do	Approaches to Goldsboro, west of Wilmington and Western Railroad.	971	1-10,000	C. Rockwell	1865.
Tennessee and Georgia.	Summit of Lookout Mountain (and tracing)	973	1-10,000	C. H. Boyd	1865.
Tennessee	Approaches and defenses of Knoxville	920	1-10,000	Gen. J. G. Foster and R. H. Talcott.	1863-64.
Do	Chattanooga and approaches	926	1-10,000	W. F. Smith and F. W. Dorr.	1863.
Do	Supplement, map of the battlefield of Chattanooga	926	1-42,240	.... do	1863.
Do	Approaches to Nashville from the south and west	931	1-10,000	F. W. Dorr	1864.
Do	Edgefield and approaches to Nashville from the north	932	1-10,000	J. W. Donn	1864.
Georgia	Chickamauga battlefield	934	1-20,000	C. H. Boyd	1864.
Do	Mission Ridge (tracing)	934	1-5,000	Major Monhart	1864. (?)
Do	Battlefield, supplementary sketch (tracing)	934	1-20,000	C. H. Boyd	1865.
Illinois, Kentucky, and Tennessee.	Tennessee River, from Paducah, Ky., to Clifton, Tenn. (reconnaissance).	1909	1-40,000	F. H. Gerdes	1865.
Alabama	Tennessee River, from Chickasaw to Florence	1901	1-40,000	....do	1865.
Tennessee, Mississippi, and Alabama.	Tennessee River, from Clifton, Tenn., to Eastport, Miss. (reconnaissance).	1910	1-40,000	....do	1865.
Illinois	River front and harbor of naval depot at Mound City	1912	1-4,000	....do	1864.
Do	Navy-yard at Mound City	1913	1-10,000	....do	1864.
Kentucky, Illinois, and Missouri.	Mississippi River, from Cairo to Grays Point (reconnaissance).	1914	1-20,000	....do	1865.
Do	....do	1915	1-40,000	....do	1865.

List of original topographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Topographer.	Date.
	MISCELLANEOUS AND WAR MAPS—continued.				
Illinois and Missouri.	Mississippi River, from Grays Point to Wittenberg (reconnaissance).	1916	1-20,000	F. H. Gerdes	1865.
Do	do	1917	1-40,000	do	1865.
Do	Mississippi River, from Wittenberg to St. Marys (reconnaissance).	1918	1-20,000	do	1865.
Illinois and Kentucky.	Ohio River, from Mound City to Cairo (reconnaissance).	938	1-10,000	do	1864.
Illinois and Missouri.	Mississippi River, from Wittenberg to St. Marys (reconnaissance).	1919	1-40,000	do	1865.
Louisiana	Red River above Alexandria, showing position of breakwaters at the Falls.	1921	1-2,000	do	1862-64.
Do	Approaches to Fort De Russy (below Alexandria)	1922	1-5,000	do	1864.
Missouri	Military Defenses of St. Louis	852	1-10,000	J. Mechan	1862.
Do	Carondelet	907	1-10,000	R. M. Bache	1863.
Do	Fortifications of St. Louis	908	1-10,000	do	1862.
Do	St. Louis and vicinity	921	1-20,000	R. D. Cutts	1862.

APPENDIX No. 11—1895.

SUBDIVISION 2.

LIST OF ORIGINAL HYDROGRAPHIC SHEETS, GEOGRAPHICALLY ARRANGED, REGISTERED IN THE ARCHIVES OF THE UNITED STATES COAST AND GEODETIC SURVEY

FROM

JANUARY, 1834, TO DECEMBER 31, 1895.

NOS. 1 TO 2222, INCLUSIVE.

UNITED STATES COAST AND GEODETIC SURVEY.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey from January, 1834, to December 31, 1895.

NOS. 1 TO 2222, INCLUSIVE.

State.	Locality.	Registered number.	Scale.	Hydrographer.	Date.
Labrador	Isle of Ponds to Cape Chudleigh	817	1-600,000	A. Murray, U. S. N	1860.
	Profile chart, North Atlantic Ocean	1532	1-2,400,000	Compiled	1882.
Maine to Massachusetts.	Gulf of Maine and Georges Shoals	1305	1-400,000	....do	1853-75.
Nova Scotia to Massachusetts.	Off Cape Sable and coasts of Maine, New Hampshire, and Massachusetts.	1208	1-1,200,000	J. A. Howell, U. S. N	1872-73.
Maine to Massachusetts.	Gulf of Maine (see No. 1305)	1303 *a*	1-400,000	C. D. Sigsbee, U. S. N	1875.
Do	....do	1302 *a*	1-400,000	J. A. Howell, U. S. N	1874.
	Grand Manan Bank	1302 *b*	1-80,000	....do	1874.
Do	Off Maine, New Hampshire, and Massachusetts	700	1-300,000	A. Murray, U. S. N	1858-59.
Maine and New Hampshire.	Matinicus Rock to Isle of Shoals (see No. 1305)	1304	1-200,000	R. Platt, U. S. N	1874.
Maine	Cashes Ledge, Gulf of Maine (see No. 1305)	1303 *b*	1-40,000	C. D. Sigsbee, U. S. N	1875.
New Hampshire	Jeffreys Ledge (see No. 1305)	861	1-150,000	T. S. Phelps, U. S. N	1863.
Massachusetts	Massachusetts Bay, Stellwagen Bank	516	1-80,000	H. S. Stellwagen, U. S. N	1854-55.
Do	Massachusetts Bay, Stellwagen Bank (see No. 1305)	457	1-100,000	....do	1854.
Do	Massachusetts coast (see No. 1305)	593	1-300,000	C. R. P. Rodgers, U. S. N	1857.
Do	Georges Shoal	1207 *c*	1-3,018	J. E. Pillsbury, U. S. N	1885.
Do	Georges Shoal (reconnaissance) (see No. 1305)	1207 *b*	1-40,000	J. A. Howell, U. S. N	1872.
Do	Cultivator Shoal (see No. 1305)	1207 *a*	1-20,000	....do	1872.
Do	Georges Bank	1837	1-400,000	J. E. Pillsbury, U. S. N	1888-89.
Do	Nantucket Shoals, Davis Bank and Fishing Rip	2089	1-40,000	C. E. Vreeland, U. S. N	1891.
Do	Nantucket Shoals, Phelps Bank and Asia Rip	745	1-100,000	T. S. Phelps, U. S. N	1860-61.
Do	Nantucket Shoals, approaches (see No. 1305)	440	1-300,000	H. S. Stellwagen, U. S. N	1853-4-5-6.
Do	Nantucket to the southward	406	1-400,000	....do	1853.
Massachusetts to Florida.	Georges Bank to Jupiter Inlet (current sections across Gulf Stream).	1499 *a*	1-1,200,000	J. R. Bartlett, U. S. N	1880-81.
Do	....do	1499 *b*	1-1,200,000	....do	1880-81.
Massachusetts to North Carolina.	Georges Bank to Cape Hatteras	1498 *a*	1-1,200,000	Compiled	1880-81-82.
Do	Cape Cod to Cape Lookout	1458 *a*	1-1,200,000	J. R. Bartlett, U. S. N	1880.
Massachusetts to Virginia.	Nantucket to Cape Henry (see Nos. 1498 *a*, *b*)	1537	1-1,200,000	J. R. Bartlett and W. H. Brownson, U. S. N.	1882.
Massachusetts to Delaware.	Gay Head to Cape Henlopen (compiled)	670	1-400,000	T. R. Gedney, R. Bache, and C. H. McBlair, U. S. N.	1859.
Massachusetts to New York.	Phelps Bank to Montauk Point	1782	1-300,000	J. E. Pillsbury, U. S. N	1887.
Massachusetts and Rhode Island.	No Mans Land to Point Judith	283	1-100,000	J. Swartwout, U. S. N	1851.
New York to Bermuda.	Montauk Point to Gibbs Hill Light (soundings and temperatures).	1652 *a*	1-729,600	Compiled	1882.
Do	....do	1652 *b*	1-729,600	....do	1882.
New York to Delaware.	Montauk Point to Cape Henlopen	1558	1-300,000	W. H. Brownson, U. S. N	1882-83.
Do	....do	100	1-400,000	T. R. Gedney, U. S. N	1842.
Do	Block Island to Cape Henlopen	101	1-400,000	....do	1844.
New Jersey	Barnegat to Cape May	749	1-200,000	T. S. Phelps, U. S. N	1861.
Delaware and Maryland.	Southeast of Delaware Bay entrance	189	1-200,000	S. P. Lee, U. S. N	1847.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Delaware to North Carolina.	Cape Henlopen to Cape Hatteras	237	1–400,000	T. A. Jenkins, U. S. N	1849–50.
Delaware to Maryland.	Cape Henlopen to Cape Charles	1720	1–200,000	J. E. Pillsbury, U. S. N	1886.
Virginia	Cape Charles to the eastward	2118	1–100,000	C. E. Vreeland, U. S. N	1892.
Virginia to North Carolina.	Cape Charles to Cape Hatteras	1721	1–200,000	J. E. Pillsbury, U. S. N	1886.
Do	Cape Henry to Cape Hatteras	674	1–200,000	A. Murray, U. S. N	1859.
Do	Cape Henry to Cape Lookout (see Nos. 1498 *a*, *b*)	1500 *a*	1–600,000	J. R. Bartlett, U. S. N	1881.
North Carolina	Cape Hatteras to Cape Fear	686	1–200,000	A. Murray, U. S. N	1859.
Virginia to North Carolina.	Cape Henry to Cape Lookout	767	1–500,000	.....do	1859.
North Carolina to Florida.	Currituck Light to Jupiter Inlet (Gulf Stream examination).	1561	1–1,200,000	J. R. Bartlett, U. S. N	1880–81.
Do	Cape Hatteras to Cape San Blas (Gulf Stream axis temperature).	468	1–1,800,000	O. H. Berryman, U. S. N	1855.
North Carolina to Bermuda.	Cape Hatteras to Bermuda Islands (temperatures)	1563 *a*	1–729,600	J. R. Bartlett, U. S. N	1882.
North Carolina	Ocracoke Inlet to Cape Fear	884	1–240,000	R. Platt, U. S. N	1865–66.
North Carolina to Florida.	Cape Lookout to St. Augustine	768	1–500,000	A. Murray, U. S. N	1860.
North Carolina to South Carolina.	Cape Lookout to Cape Romain	1458 *b*	1–1,200,000	J. R. Bartlett, U. S. N	1880.
North Carolina to Bahamas.	Cape Hatteras to Bahama Islands	1498 *b*	1–1,200,000	Compiled	1880–81–82.
North Carolina to Florida.	Cape Lookout to St. Augustine	1500 *b*	1–600,000	J. R. Bartlett, U. S. N	1881.
North Carolina	Frying Pan Shoals	1517	1–40,000	W. H. Brownson, U. S. N	1882.
North Carolina and South Carolina.	Cape Fear to Cape Romain	694	1–300,000	J. P. Bankhead, U. S. N	1859.
South Carolina	Coast approaches	622	1–200,000	J. N. Maffitt, U. S. N	1857.
South Carolina to Florida.	Coast approaches (condemned)	653	1–300,000	T. B. Huger, U. S. N	1858.
South Carolina and Georgia.	Coast approaches	717	1–300,000	.....do	1858.
Do	.....do	728	1–300,000	J. P. Bankhead, U. S. N	1860.
Florida	Fernandina to Cape Florida	770	1–400,000	A. Murray, U. S. N	1860.
Do	St. Augustine to Jupiter Inlet (see No. 1498)	1500 *c*	1–600,000	J. R. Bartlett, U. S. N	1881.
North Carolina to Georgia.	Cape Fear to Savannah River (section lines across Gulf Stream).	1958	1–506,880	.....do	1881.
Florida	St. Johns River to Jupiter Inlet (section lines across Gulf Stream).	1957	1–506,880	.....do	1881.
	Gulf Stream section lines	1959	1–506,880	.....do	1881.
Florida	Straits of Florida	1624	1–200,000	J. E. Pillsbury, U. S. N	1885.
Florida and Bahama.	Straits of Florida and Northwest Providence Channel.	1625	1–200,000	.....do	1885.
Florida	Straits of Florida	1090	1–400,000	R. Platt, U. S. N	1869.
Do	.....do	1091	1–400,000	.....do	1869.
Do	.....do	1665	1–300,000	J. E. Pillsbury, U. S. N	1886.
Do	Straits of Florida, Sombrero Key to Sand Key	1066	1–160,000	R. Platt, U. S. N	1868.
Florida and Cuba.	Straits of Florida, Key West to Cuba	1956	1–400,000	.....do	1866.
Bahama	Bahama Bank to the eastward (see No. 1498)	1584	1–1,200,000	W. H. Brownson, U. S. N	1882–83.
Florida	Key West to Charlotte Harbor	911	1–400,000	R. Platt, U. S. N	1867.
Do	West coast approaches	1354	1–600,000	C. D. Sigsbee, U. S. N	1875–76.
	Gulf of Mexico, southeastern part	1399	1–800,000	.....do	1877–78.
	Gulf of Mexico (soundings and temperatures)	599	1–1,200,000	B. F. Sands, U. S. N	1857–58.
	.....do	483	1–1,200,000	.....do	1854–55.
Florida	West coast	1138	1–600,000	J. A. Howell, U. S. N	1872.
Florida to Texas	Tortugas, half way to Rio Grande	1353	1–600,000	C. D. Sigsbee, U. S. N	1875–76–77.
Louisiana	Mississippi Delta	1351	1–400,000	.....do	1875–76–77.
Do	.....do	420	1–600,000	B. F. Sands, U. S. N	1854.
Florida to Louisiana.	Between Key West and Mississippi Delta (soundings and temperatures).	528	1–662,050	.....do	1856.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Louisiana and Texas.	Southwest Pass and mouth of Rio Grande	1350	1-600,000	C. D. Sigsbee, U. S. N	1875-76-77.
Louisiana to Florida.	Rio Grande, half way to Tortugas	1352	1-600,000	do	1875-76-77.
Louisiana to Texas.	Timbalier Bay to Galveston Bar	657	1-635,000	J. K. Duer, U. S. N	1858.
Mexico	Between Mexico and the Yucatan Banks (northern part).	1355	1-600,000	C. D. Sigsbee, U. S. N	1876-77.
Do	Between Mexico and the Yucatan Banks (southern part).	1356	1-600,000	do	1876-77.
Do	Yucatan Channel, Cape San Antonio to Cape Catoche.	1137	1-200,000	R. Platt, U. S. N	1872.
West Indies	West India Islands and Caribbean Sea (compiled)	1514 *a*	1-2,400,000	J. R. Bartlett, U. S. N	1879.
Do	West India Islands and Caribbean Sea (in colors)	1514 *b*	1-2,400,000	Constructed	1879.
Do	Caribbean Sea (temperature sections)	1599	1-2,400,000	J. R. Bartlett, U. S. N	1878-79-80.
	Gulf of Mexico, Yucatan Channel and Florida Straits (temperatures).	1600 *a*	1-1,200,000	C. D. Sigsbee, U. S. N	1876-78.
	Gulf of Mexico, Yucatan Channel and Florida Straits (cross sections).	1600 *b*	1-400,000	do	1876-78.
Florida to Texas.	Gulf of Mexico, Egmont Key to Padre Island	1600 *c*	1-2,400,000	do	1876-78.
	Gulf of Mexico (profile lines)	1600 *d*		do	1876-78.
	Caribbean Sea	1600 *e*	1-10,000,000	J. R. Bartlett, U. S. N	1879.
	Caribbean Sea (profile and temperatures)	1563 *b*	1-2,400,000	do	1878-80-81.
Labrador	Eclipse Harbor	818	1-40,000	A. Murray, U. S. N	1866.
Maine and New Brunswick.	Monument Stream, North Lake, and Thorofare	2139	1-10,000	J. Hergesheimer	1892.
Do	Grand Lake, head to Piney Point	2138	1-10,000	do	1892.
Do	Grand Lake, Piney Point to Black Rock	2137	1-10,000	do	1892.
Do	Grand Lake, Black Rock to Round Rock	2136	1-10,000	do	1892.
Do	Grand Lake, south end Chiputneticook Lake to Hinkley Point.	2171	1-10,000	S. Forney	1892.
Do	Chiputneticook Lake, Hinkley Point to Musquash River.	2172	1-10,000	do	1892.
Do	Chiputneticook Lake, Musquash River to St. Croix	2173	1-10,000	do	1892.
Do	St. Croix River, St. Croix to Jo George Rips	1931	1-10,000	C. M. Bache	1890.
Do	St. Croix River, Jo George Rips to Meeting House Rips.	2000	1-10,000	J. A. Flemmer	1890.
Do	St. Croix River, Meeting House Rips to Millbury Brook.	2001	1-10,000	do	1890.
Do	St. Croix River, Millbury Brook to Gibbs Landing	2003	1-10,000	do	1890.
Do	St. Croix River, Gibbs Landing to Ryans Rip	2006	1-10,000	do	1890.
Do	St. Croix River, Ryans Rip to Calais	1940	1-10,000	E. Ellicott	1889.
Do	St. Croix River, Calais to Oak Bay	1796	1-10,000	F. H. Crosby, U. S. N	1887.
Do	St. Croix River, Oak Bay to Robbinston	1795	1-10,000	do	1887.
Do	St. Croix River, Robbinston to north end Deer Island.	1794	1-10,000	do	1887.
Do	St. Croix River, north end Deer Island to Eastport	1793	1-10,000	do	1887.
Do	Head harbor and eastern approaches to Friar Roads.	848	1-10,000	C. O. Boutelle	1861.
Do	Friar Roads, Kendall Head to Lubec	847	1-10,000	do	1861.
Do	Friar Islands to West Quoddy Head	895	1-10,000	H. L. Marindin	1866.
Maine	Cobscook Bay, Treat Island to Shackford Head.	2027	1-10,000	S. M. Ackley, U. S. N	1890.
Do	Cobscook Bay, Shackford Head to Denbows Neck	1798	1-10,000	F. H. Crosby, U. S. N	1887.
Do	Cobscook Bay, Denbows Neck to Pembroke	1840	1-10,000	do	1888.
Do	Cobscook Bay, Denbows Neck to Dram Island and Whiting.	1838	1-10,000	do	1888.
Do	Cobscook Bay, Dram Island to Dennysville	1839	1-10,000	do	1888.
Do	West Quoddy Head to Cross Island, off shore	1693	1-40,000	J. M. Hawley and F. H. Crosby, U. S. N.	1886-87.
Do	West Quoddy Head to Jims Head	1692	1-10,000	J. M. Hawley, U. S. N	1886.
Do	Jims Head to Black Point Cove	1691	1-10,000	do	1886.
Do	Black Point Cove to Cape Wash, including Little Machias Bay.	1690	1-10,000	do	1886.
Do	Cross Island to Nash Island, off shore	1576	1-40,000	A. S. Snow, U. S. N	1883.
Do	Machias Bay, entrance and Cross Island Narrows	1689	1-10,000	J. M. Hawley, U. S. N	1886.
Do	Machias Bay, Bucks Head to Round Island	1688	1-10,000	E. D. F. Heald, U. S. N	1885.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Maine	Machias Bay, Round Island to Machias	1687	1-10,000	E. D. F. Heald, U. S. N.	1885.
Do	Libby Islands to Little Kennebec Bay	1686	1-10,000	do	1885.
Do	Englishmans Bay and Rogue Island Harbor	1685	1-10,000	do	1885.
Do	Chandler Bay and River	1684	1-10,000	do	1885.
Do	Moose-a-bec Reach and eastern approaches	1059	1-10,000	F. F. Nes	1870.
Do	Black Ledges to Egg Rock and Mud Hole Channel	1574	1-10,000	A. S. Snow, U. S. N.	1883.
Do	Great Wass Island to Nash Island	1060	1-10,000	F. F. Nes	1870.
Do	Indian and West rivers to Plummer Island	1061	1-10,000	do	1870.
Do	Black Rocks and vicinity	1835	1-10,000	J. E. Pillsbury, U. S. N.	1888.
Do	Nash Island to Schoodic Point, off shore	1398	1-40,000	T. F. Jewell, U. S. N.	1878.
Do	Pleasant Bay	1608	1-10,000	E. D. F. Heald, U. S. N.	1884.
Do	Pleasant River	1644	1-10,000	do	1885.
Do	Harrington Bay and tributaries	1610	1-10,000	do	1884.
Do	Narraguagus Bay to Half Tide Ledge and Pigeon Hill Bay.	1567 *b*	1-10,000	do	1883.
Do	Narraguagus Bay, Half Tide Ledge to Millbridge.	1567 *a*	1-10,000	do	1883.
Do	Narraguagus Bay to Narraguagus River	1609	1-10,000	do	1884.
Do	Pigeon Hill Bay and approaches	1528	1-10,000	H. G. Colby, U. S. N.	1882.
Do	Dyer Bay	1510	1-10,000	do	1881.
Do	Gouldsboro Bay	1505	1-10,000	do	1881.
Do	Prospect and Schoodic harbors and approaches	1127	1-10,000	H. Anderson	1871.
Do	Schoodic Head to Great Spoon Island, off shore	1372	1-40,000	J. F. Moser, U. S. N.	1877.
Do	Frenchmans Bay, Baker Island to Iron Bound Island.	1424	1-20,000	C. M. Chester, U. S. N.	1879.
Do	Frenchmans Bay, Stony Beach to Schooner Head	1215	1-10,000	J. W. Donn	1873.
Do	Frenchmans Bay, Schooner Head to Bar Harbor	1216	1-10,000	do	1873.
Do	Frenchmans Bay, Schoodic Point to Jordans Island and Winter Harbor.	938	1-10,000	H. Anderson	1867.
Do	Frenchmans Bay, Bar Harbor to Meadow Point	1217	1-10,000	J. W. Donn	1873.
Do	Frenchmans Bay, Bar Harbor to Calf Island	1402	1-10,000	S. W. Ackley, U. S. N.	1878.
Do	Frenchmans Bay, Flanders Bay	1436 *b*	1-10,000	J. F. Moser, U. S. N.	1879.
Do	Frenchmans Bay, Sullivan Harbor to The Nub	1436 *a*	1-10,000	do	1879.
Do	Frenchmans Bay, Taunton Bay to Sullivan Harbor	1474 *a*	1-10,000	S. M. Ackley, U. S. N.	1880.
Do	Frenchmans Bay, Skilling River and approaches	1474 *b*	1-10,000	do	1880.
Do	Southwest Harbor and Bunkers Ledge	1121	1-10,000	J. W. Donn	1871.
Do	Northeast Harbor and Somes Sound	1122	1-10,000	do	1871.
Do	Race Point to Bass Harbor Head	1120	1-10,000	do	1871.
Do	Blue Hill Bay, Bass Harbor Head to Bar Island	1164	1-10,000	do	1872.
Do	Blue Hill Bay, Mackerel Cove to Trumpet Island	1401	1-10,000	J. M. Hawley, U. S. N.	1878.
Do	Blue Hill Bay, Herrick Bay to Hardwood Island	1433 *a*	1-10,000	U. Sebree, U. S. N.	1879.
Do	Blue Hill Bay, Bartlett Narrows to Dodges Point	1245 *b*	1-10,000	J. W. Donn	1874.
Do	Blue Hill Bay, Tinker Island to Newbury Neck	1433 *b*	1-10,000	U. Sebree, U. S. N.	1879.
Do	Blue Hill Bay, Blue Hill Harbor to Allen Cove	1434	1-10,000	C. M. Chester, U. S. N.	1879.
Do	Blue Hill Bay, Morgan and Union River bays	1435 *a*	1-10,000	do	1879.
Do	Blue Hill Bay, Goose Cove to Bartlett Island	1435 *b*	1-10,000	do	1879.
Do	Blue Hill Bay, Mount Desert Narrows to Bartlett Narrows.	1245 *a*	1-10,000	J. W. Donn	1874.
Do	Blue Hill Bay, Jordan River	1474 *c*	1-10,000	S. M. Ackley, U. S. N.	1880
Do	Great Gott Island to Long Island and Harbor Island.	1453	1-10,000	J. F. Moser, U. S. N.	1879.
Do	Burnt Coat Harbor to Marshall Island	1452	1-10,000	do	1879.
Do	Casco Passage and Eggemoggin Reach to Sedgwick Harbor.	1366	1-10,000	J. M. Hawley, U. S. N.	1876-77.
Do	Eggemoggin Reach, Sedgwick Harbor to Bucks Harbor.	1260	1-10,000	H. Anderson	1874.
Do	Great Spoon Island to Seal Island, off shore	1074	1-20,000	F. P. Webber	1870
Do	Isle au Haut, Head Harbor	1357	1-5,000	J. M. Hawley, U. S. N.	1877
Do	Jericho Bay, Saddle Back Island to Great Spoon Island.	1407	1-10,000	J. F. Moser, U. S. N.	1878
Do	Merchants Row and Deer Island Thoroughfare	1400 *a*	1-10,000	J. M. Hawley, U. S. N.	1877.
Do	Deer Isle, Southeast Harbor and approaches	1400 *b*	1-10,000	do	1878.
Do	Seal Island to Metinic Island, off shore	1051	1-20,000	C. Junken	1866.
Do	Seal Island to Muscle Ridge Islands, off shore	943	1-20,000	do	1866-67.
Do	East Penobscot Bay, Isle au Haut Bay, Saddle Back Ledge to Eagle Island.	1028	1-20,000	do	1869.

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Maine	East Penobscot Bay, Isle au Haut Bay, The Washers to Thurlow Island.	1406	1-10,000	J. F. Moser, U. S. N	1878.
Do	East Penobscot Bay, south of Fox Islands	1073	1-10,000	F. P. Webber	1870.
Do	East Penobscot Bay, Seal Bay and vicinity	1142	1-10,000	.....do	1871.
Do	East Penobscot Bay, Fox Islands Thoroughfare, east entrance.	983	1-10,000	C. Junken	1868.
Do	East Penobscot Bay, Mark Island to Little Deer Isle.	1321	1-10,000	J. M. Hawley, U. S. N.	1875.
Do	East Penobscot Bay, Fox Islands to Bucks Harbor	1261	1-10,000	H. Anderson	1873-74.
Do	East and West Penobscot bays, Dillinghams to Dice Head.	1143	1-20,000	F. P. Webber	1871.
Do	East Penobscot Bay, Castine Harbor and Bagaduce River to Narrows.	1259	1-10,000	H. Anderson	1873.
Do	East Penobscot Bay, Bagaduce River and Narrows	1472	1-10,000	S. M. Ackley, U. S. N	1880.
Do	West Penobscot Bay, Green Island Light to Crockett Cove.	1029	1-10,000	C. Junken	1869.
Do	West Penobscot Bay, The Basin, Vinal Haven Island.	1075	1-10,000	F. P. Webber	1870.
Do	West Penobscot Bay, Fox Island Thoroughfare, west entrance.	982	1-10,000	C. Junken	1868.
Do	West Penobscot Bay, east of Muscle Ridge Channel	1030	1-20,000	.....do	1869.
Do	West Penobscot Bay, Owls Head Bay and Rockland Harbor.	819	1-10,000	W. S. Edwards	1863.
Do	West Penobscot Bay, Owls Head Bay to Job Island	1086	1-20,000	F. P. Webber	1869.
Do	West Penobscot Bay, island south of Long Island	1087	1-10,000	.....do	1869.
Do	West Penobscot Bay, Rockport and Camden harbors.	873	1-10,000	H. Anderson	1865.
Do	West Penobscot Bay, Gilkey Harbor southward	1144	1-10,000	F. P. Webber	1871.
Do	West Penobscot Bay, Belfast Bay and River	1068	1-10,000	H. Anderson	1872.
Do	Penobscot River, Long Island to Searsport and Sandy Point.	1258	1-20,000	.....do	1872.
Do	Penobscot River, Sandy Point to Bucksport	1257 *a*	1-10,000	.....do	1874.
Do	Penobscot River, Bucksport to Parker Point	1257 *b*	1-10,000	.....do	1874.
Do	Penobscot River, Parker Point to Smith Cove	1473	1-10,000	S. M. Ackley, U. S. N.	1880.
Do	Penobscot River, Smith Cove to Bangor	934	1, 10,000	J. A. Sullivan	1867.
Do	Muscle Ridge Islands	953	1-10,000	R. E. Halter	1866.
Do	Muscle Ridge Channel	952 *a*	1-10,000	R. E. Halter and C. Junken.	1866-67.
Do	Weskeag River	952 *b*	1-10,000	J. S. Bradford	1873.
Do	Matinicus Rock to Seguin Island, off shore	1836	1-40,000	J. E. Pillsbury, U. S. N.	1888.
Do	Metinic Island to Monhegan Island	823 *a*	1-40,000	E. Cordell	1863.
Do	Monhegan Island to Pumpkin Island, off shore	746	1-20,000	T. S. Phelps, U. S. N.	1860.
Do	Metinic Island	823 *b*	1, 20,000	C. Junken	1867.
Do	Monhegan Island	823 *c*	1-20,000	.....do	1867.
Do	Sprucehead Island to Mosquito Island	907	1-10,000	R. E. Halter	1866.
Do	Georges Islands	872	1-10,000	R. E. Halter and C. Fendall.	1865.
Do	St. Georges River to Narrows	859	1-10,000	F. P. Webber	1864.
Do	St. Georges River Narrows to Thomaston	858	1-10,000	.....do	1864.
Do	Meduncook River and Pleasant Point Gut	951	1-10,000	R. E. Halter	1867.
Do	Muscongus Bay, Pemaquid Point to Cranberry Island.	986	1-10,000	.....do	1868.
Do	Muscongus Bay, Cranberry Island to Hungry Island.	950	1-10,000	.....do	1867.
Do	Medomak River, from Bremen, Long Island, to Waldoboro.	960	1-10,000	H. Anderson	1866.
Do	Johns Bay and River, from entrance to head	920	1-10,000	R. E. Halter	1867.
Do	Damariscotta River and Linekin Bay, from Pumpkin Island to Miller Island.	791	1-10,000	J. P. Bankhead	1860.
Do	Damariscotta River, from Miller Island to Newcastle.	903	1-10,000	E. Hergesheimer	1866.
Do	Seguin Island to Cape Elizabeth, off shore	933	1-40,000	R. Platt, U. S. N.	1867.
Do	Damiscove Island to Small Point	696	1-40,000	J. Wilkinson, U. S. N.	1859.
Do	Sheepscot River, mouth, and Booth Bay, from Damiscove Island to Hendricks Head Light.	771	1-10,000	T. S. Phelps, U. S. N	1860.
Do	Sheepscot River, from Hendricks Head Light to Hodgdons Ledge.	675	1-10,000	J. H. Moore, U. S. N	1858.
Do	Sheepscot River, from Hodgdons Ledge to Wiscasset.	676	1-10,000	.....do	1858.
Do	Back River and Ebenicook Harbor	891	1-10,000	E. Hergesheimer	1866.
Do	Hockomock Bay, Knubble Bay, and approaches	776	1-10,000	F. H. Gerdes	1862.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Maine	Great and Little Hell Gate and Goose Rock Passage	930	1-10,000	J. S. Bradford	1867.
Do	Hockomock Bay, Knubble Bay, and Brooking Bay	929	1-10,000	....do	1867.
Do	Montseag Bay	775	1-10,000	F. H. Gerdes	1862-67.
Do	Upper Hell Gate	893 *a*	1-10,000	H. Anderson	1865.
Do	Hell Gate, Back Door	893 *b*	1-5,000	J. S. Bradford	1867.
Do	Sagadahoc Bay and Todd Bay	971	1-10,000	....do	1868.
Do	Kennebec River, approaches and entrance	552	1-10,000	S. D. Trenchard, U. S. N.	1856-57.
Do	Kennebec River, Cox Head to Bath	639	1-10,000	....do	1857.
Do	Kennebec River, Bath to Lines Island	693	1-10,000	J. H. Moore, U. S. N	1858.
Do	Kennebec River, Merrymeeting Bay, Lines Island, to Swan Island.	790	1-10,000	F. H. Gerdes	1861.
Do	Kennebec River, Swan Island to Richmond	1064	1-10,000	C. H. Boyd	1869.
Do	Kennebec River, Richmond to Gardiner	1065	1-10,000	....do	1870.
Do	Kennebec River, Gardiner to Augusta	2036	1-10,000	S. Forney	1890.
Do	Casco Bay, approaches	860	1-40,000	T. S. Phelps, U. S. N	1864.
Do	....do	664	1-40,000	W. G. Temple, U. S. N.	1857-58.
Do	Casco Bay, lower part	754	1-20,000	C. A. Schott	1861.
Do	Casco Bay, lower part, part of No. 754	726	1-20,000	J. Wilkinson, U. S. N	1859.
Do	Casco Bay, lower part	602	1-10,000	S. D. Trenchard, U. S. N	1856.
Do	....do	614	1-10,000	....do	1856.
Do	Casco Bay, lower part; Cape Small, Lumbo Ledge, and Halfway Rock.	972	1-10,000	J. S. Bradford	1868.
Do	Casco Bay, upper part	820	1-10,000	W. S. Edwards	1863.
Do	Casco Bay, Quohog Bay	857	1-10,000	A. Strausz	1864-65.
Do.	Casco Bay, Harpswell Sound	839	1-10,000	F. H. Gerdes	1863.
Do	Casco Bay, Maquoit Bay, Middle Bay, and Mare Point Bay.	840	1-10,000	....do	1863.
Do	Casco Bay, Maquoit Bay, Middle Bay, Head of Harpswell Sound, and waters connecting.	1008	1-10,000	H. Anderson	1869.
Do	Casco Bay, New Meadow River	899	1-10,000	J. W. Donn	1866.
Do	Casco Bay, Portland Harbor approaches	403	1-20,000	M. Woodhull, U. S. N	1853.
Do	Casco Bay, Portland Harbor rocks	796	1-20,000	T. S. Phelps, U. S. N.	1863.
Do	....do	841	1-20,000	....do	1863.
Do	Casco Bay, Portland Harbor, rocks off Cape Elizabeth.	824	1-789	M. Woodhull, U. S. N	1853.
Do	Casco Bay, Portland Harbor, Trinity Reef to Portland Head, and Whitehead Passage.	788	1-20,000	D. Cordell	1862.
Do	Casco Bay, Portland Harbor, approaches	601	1-5,000	F. A. Roe	1857.
Do	Casco Bay, Portland Harbor and approaches	404	1-10,000	M. Woodhull, U. S. N	1852-53.
Do	Casco Bay, Portland Harbor	949	1-5,000	R. Platt, U. S. N.	1867.
Do	Casco Bay, Portland Harbor, bank off Union Wharf.	600	1-5,000	S. D. Trenchard, U. S. N	1857.
Do	....do	684	1-5,000	J. Wilkinson, U. S. N	1859.
Do	Casco Bay, Portland Harbor, east part	1033 *a*	1-2,400	H. Anderson	1869.
Do	Casco Bay, Portland Harbor, west part	1033 *b*	1-2,400	....do	1869.
Do	Casco Bay, Portland Harbor	1032	1-1,200	....do	1868.
Do	Casco Bay, Portland Harbor, Standwater Creek	1034 *a*	1-2,400	....do	1869.
Do	Casco Bay, Portland Harbor, Back Creek	1034 *b*	1-2,400	....do	1869.
Do	Cape Elizabeth to Kennebunkport	699	1-40,000	A. Murray, U. S. N.	1859.
Do	Richmond Island Harbor	243	1-10,000	M. Woodhull, U. S. N	1850.
Do	Saco Bay, from Spurwink River to Scarboro River	1634 *a*	1-10,000	J. E. Pillsbury, U. S. N.	1885.
Do	Saco Bay, from Old Orchard Beach to Hoyts Neck	1634 *b*	1-10,000	F. F. Nes	1875.
Do	Saco River, approaches and Wood Island Harbor	1117 *b*	1-10,000	J. S. Bradford	1871.
Do	Wood Island Harbor	739	1-10,000	A. Murray, U. S. N.	1859.
Do	Saco River, entrance	882	1-5,000	G. Davidson	1866.
Do	Saco River to Chandler Point	942	1-5,000	F. F. Nes	1867.
Do	Saco River to Chandler Point to Biddeford	941	1-5,000	....do	1867.
Do	Cape Porpoise and Stage Island Harbor	1117 *a*	1-10,000	J. S. Bradford	1871.
Do	....do	740	1-10,000	A. Murray, U. S. N.	1859.
Do	Kennebunkport to Isles of Shoals	667	1-40,000	....do	1858.
Do	York River, entrance and harbor	376	1-10,000	M. Woodhull, U. S. N.	1853.
Do	Boon Island to York Harbor, off shore	366	1-20,000	....do	1853.
Do.	Moore Rock	667 *bis*	1-10,000	J. F. Moser, U. S. N	1879.
Maine and New Hampshire.	Portsmouth Harbor, approaches	294	1-20,000	M. Woodhull, U. S. N	1851.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Maine and New Hampshire.	Isles of Shoals	741 *a*	1-10,000	A. Murray, U. S. N.	1859.
Do.	do	741 *b*	1-10,000	R. Platt, U. S. N.	1874.
New Hampshire.	Pulpit Rock to Great Boars Head	1068	1-10,000	H. Anderson	1870.
Do.	Great Boars Head to East Salisbury	1069	1-10,000	do	1870.
Massachusetts	Newburyport to Portsmouth	627	1-20,000	C. R. P. Rodgers, U. S. N.	1857.
Do.	Merrimac River, entrance	1395	1-5,000	C. M. Chester	1878.
Do.	Newburyport Harbor	292	1-10,000	M. Woodhull, U. S. N.	1851.
Do.	Merrimac River, Mitchells Falls	1012	200 ft. to 1 in.	H. Mitchell	1867.
Do.	Cape Ann to Newburyport	594	1-20,000	C. R. P. Rodgers, U. S. N.	1857.
Do.	Annisquam to Ipswich	574	1-20,000	S. D. Trenchard, U. S. N.	1856.
Do.	Annisquam and Ipswich harbors	346	1-10,000	M. Woodhull, U. S. N.	1852.
Do.	Thatcher Island to Annisquam	597	1-20,000	C. R. P. Rodgers, U. S. N.	1857.
Do.	Gloucester Harbor and approaches	396 *a*	1-10,000	H. S. Stellwagen, U. S. N.	1853.
Do.	Bar, between Emmerson Point and Milk Island	396 *b*	1-10,000	J. S. Bradford and J. E. Pillsbury, U. S. N.	1873-85.
Do.	Salem Harbor and approaches	284	1-10,000	C. H. McBlair, U. S. N.	1850-51.
Do.	Salem Harbor, off Marblehead	651	1-5,000	W. G. Temple, U. S. N.	1858.
Do.	Chelsea Beach to Marblehead Neck	413	1-20,000	H. S. Stellwagen, U. S. N.	1853-54.
Do.	Lynn Harbor	662	1-10,000	A. Murray, U. S. N.	1858.
Do.	Broad Sound and entrance to Lynn Harbor	2129	1-10,000	L. K. Reynolds, U. S. N.	1892.
Do.	Boston Harbor and approaches	221	1-20,000	C. H. Davis, U. S. N.	1846-47-48.
Do.	Boston Harbor (comparative map)	1960	1-20,000	A. S. Wadsworth and C. S. Davis, U. S. N.	1817-46-53.
Do.	Boston Harbor (reduction of No. 1960)	1961	1-20,000	A. S. Wadsworth	1817.
Do.	Boston Harbor, Centurian and Hangman rocks	652	1-10,000	W. G. Temple, U. S. N.	1858.
Do.	Boston Harbor, Shirley Gut, examination	648	1-5,000	do	1858.
Do.	Boston Harbor, entrance	2146	1-10,000	E. M. Hughes, U. S. N.	1892.
Do.	Boston Harbor, middle part	2161	1-10,000	W. F. Low, U. S. N.	1892-93.
Do.	Boston Harbor, Chelsea and Charles rivers and Mystic River.	2156	1-10,000	do	1892-93.
Do.	Boston Harbor, inner	850	1-10,000	A. Boschke	1861.
Do.	Boston Harbor (compiled)	1955	1-10,000	do	1861.
Do.	Boston Harbor, water front, along wharves	2141	1-2,500	W. F. Low, U. S. N	1892.
Do.	Boston Harbor, inner harbor	178	1-5,000	C. H. Davis, U. S. N.	1846.
Do.	Boston Harbor (current chart)	1971	1-20,000	do	1847-48.
Do.	do	1972	1-20,000	do	1847-48.
Do.	do	1973	1-20,000	do	1847-48.
Do.	Boston Harbor, Town, Fore, and Back rivers, and Weymouth River above the bridge.	1021	1-10,000	J. S. Bradford	1869.
Do.	Boston Harbor, Minots Ledge to Scituate Harbor	2133	1-10,000	C. E. Vreeland, U. S. N.	1892.
Do.	Cohasset Harbor	2134	1-5,000	do	1892.
Do.	Minots Ledge, off Boston Harbor	412	1-5,000	H. S. Stellwagen, U. S. N.	1853.
Do.	Stellwagen and other dangerous ledges near Cohasset, off Boston Bay.	582	1-10,000	do	1856.
Do.	Massachusetts Bay and Stellwagen Bank	516	1-80,000	do	1854-55.
Do.	Phelps Ledge, Green Harbor River entrance	183	1-40,000	C. H. Davis, U. S. N	1854.
Do.	Plymouth Harbor	422	1-10,000	M. Woodhull, U. S. N.	1853.
Do.	Plymouth Harbor, approaches from Manomet Point to Pier Head.	1339	1-10,000	F. F. Nes	1875.
Do.	Plymouth Harbor	1067	1-10,000	H. Anderson	1870.
Do.	Duxbury Bay	1035	1-10,000	do	1867-70.
Do.	Cape Cod Bay, Provincetown Harbor	578	1-40,000	H. S. Stellwagen, U. S. N.	1856.
Do.	Cape Cod Bay, Provincetown Harbor (No. 578 enlarged).	578 *bis*	1-10,000	A. Boschke	1868.
Do.	Cape Cod Bay, Scusset Beach	772	1-10,000	J. Wilkinson, U. S. N.	1860.
Do.	Cape Cod Bay, Barnstable Harbor	751	1-10,000	H. Mitchell	1861.
Do.	Cape Cod Bay, Wellfleet Harbor	249	1-20,000	C. H. McBlair, U. S. N.	1849-50.
Do.	Cape Cod Bay, Provincetown Harbor	2019	1-10,000	H. L. Marindin	1890.
Do.	Cape Cod Bay, Provincetown Harbor, east part	2053 *a*	1-10,000	H. L. Whiting	1867.
Do.	Cape Cod Bay, Provincetown Harbor, west part	2053 *b*	1-5,260	do	1867.
Do.	Cape Cod, north and west shore, and west part of Provincetown Harbor.	1952	1-10,000	H. L. Marindin	1889.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Massachusetts	Cape Cod, north and east shore, and east part of Provincetown Harbor.	1951	1-10,000	H. L. Marindin...........	1889.
Do............	Cape Cod, from Wood End to Nauset Harbor	519	1-40,000	H. S. Stellwagen, U. S. N ..	1855-56.
Do............	Cape Cod, east shore, from Highland Light to Cahoons Hollow.	1903	1-10,000	H. L. Marindin...........	1888.
Do............	Cape Cod, east shore, from Cahoons Hollow to Nauset Harbor.	1902	1-10,000	.....do	1888.
Do............	Cape Cod, east shore, Nauset Beach (cross sections)..	1817	1-10,000	.....do	1887.
Do............	Cape Cod, east shore, from Nauset Lights to Monomoy.	570	1-40,000	H. S. Stellwagen, U. S. N ..	1856.
Do......	Cape Cod, east shore, cross sections off Nauset Beach.	1818	1-10,000	H. L. Marindin...........	1887.
Do...	Cape Cod, east shore, cross sections off Chatham Beach.	1901	1-10,000	.....do	1888.
Do............	Cape Cod, east shore, Monomoy Island, off Nauset Beach.	1726	1-10,000	J. E. Pillsbury, U. S. N....	1886.
Do............	Chatham Harbor....................................	293	1-10,000	M. Woodhull, U. S. N	1851.
Do............	Monomoy Island, east side, from the point to latitude 41° 37′ N.	1727	1-10,000	J. E. Pillsbury, U. S. N.....	1886.
Do............	Monomoy Island, east side	1284	1-10,000	J. C. Kennett, U. S. N	1875.
Do............	Monomoy Shoals	387	1-30,000	M. Woodhull, U. S. N	1853.
Do............	.....do	2224	1-20,000	H. G. O. Colby, U. S. N	1895.
Do............	.....do	1149	1-20,000	F. D. Granger	1872.
Do............	Monomoy Shoals (reconnaissance)...................	961 *a*	1-40,000	G. S. Blake, U. S. N., and F. F. Nes.	1868.
Do............	.....do	961 *b*	1-20,000	.....do	1868.
Do............	Monomoy Passage....................................	1573	1-20,000	W. H. Brownson, U. S. N ..	1883.
Do............	Monomoy and Nantucket shoals	1195 *a*	1-20,000	F. D. Granger	1873.
Do............	Nantucket Shoals, South Shoals..........	223	1-40,000	C. H. Davis, U. S. N	1847-48.
Do............	Nantucket Shoals, Old and New South shoals.	179	1-40,000	.....do	1846.
Do............	Nantucket Shoals, Davis Bank, and Fishing Rip......	2089	1-40,000	C. E. Vreeland, U. S. N	1891.
Do............	Nantucket Shoals, Rose and Crown, Great Rip, Old South, and Davis shoals, and southern part of Davis Bank.	2095	1-40,000	E. M. Hughes, U. S. N	1891.
Do............	Nantucket Shoals and Great Point Rip	1195	1-10,000	F. D. Granger	1873.
Do............	Nantucket Shoals, south of Nantucket Island	2081	1-40,000	C. E. Vreeland, U. S. N	1891.
Do............	Nantucket Shoals, approaches to Great Point Shoal, Pollock Rip, Great Round, Little Round, Bearses, and Stone Horse shoals.	2101 *a b*	1-20,000	L. K. Reynolds, U. S. N....	1891.
Do............	Nantucket Shoals, approaches.........................	1285	1-40,000	J. C. Kennett, U. S. N......	1875.
Do............	Nantucket Shoals, entrance	569	1-40,000	H. S. Stellwagen, U. S. N ..	1856.
Do............	Nantucket Shoals, eastern entrance	2121	1-40,000	C. E. Vreeland, U. S. N.....	1892.
Do............	Nantucket Sound	527	1-30,000	C. R. P. Rodgers, U. S. N...	1855-56.
Do............	Nantucket Sound, eastern entrance................ ..	2225	1-20,000	H. G. O. Colby, U. S. N.....	1895.
Do............	Nantucket Sound, Handkerchief Shoal	1306	1-20,000	R. D. Hitchcock, U. S. N ...	1875.
Do............	.....do	2043	1-20,000	W. P. Elliott, U. S. N..... ..	1890.
Do............	Nantucket Sound, from Monomoy to Bishop and Clerks Light.	1243	1-20,000	F. D. Granger	1874.
Do............	Nantucket Sound, from Monomoy Island to Point Gammon.	1948	1-20,000	W. P. Elliott, U. S. N.......	1889.
Do............	Nantucket Sound, west of Monomoy.................	455 *a*	1-40,000	M. Woodhull, U. S. N	1854.
Do............	Nantucket Sound, eastern end	2193	1-40,000	G. W. Mentz, U. S. N.......	1894.
Do............	Nantucket Sound, Hyannis to Falmouth	1880	1-20,000	S. C. Paine, U. S. N.........	1888.
Do............	Nantucket Sound, Maddequet Harbor, Tuckernuck, Edwards, Shovelful, Long, and Hawes shoals.	1947	1-20,000	W. P. Elliott, U. S. N.......	1889.
Do............	Nantucket Sound, Muskegat Channel	1879	1-20,000	S. C. Paine, U. S. N.........	1889.
Do......	Nantucket Sound, Chatham Roads and Stage Harbor.	1949	1-10,000	W. P. Elliott, U. S. N.......	1889.
Do............	Nantucket Sound, Bass River and Kill Pond Bar.....	245	1-20,000	C. H. McBlair, U. S. N......	1849.
Do............	Nantucket Sound, Hyannis Harbor entrance.........	184	1-20,000	J. N. Maffitt, U. S. N	1847.
Do............	Nantucket Sound, Nantucket Harbor and approaches.	1878	1-20,000	S. C. Paine, U. S. N.........	1888.
Do.......... ..	Nantucket Sound, Nantucket Harbor.................	181	1-20,000	C. H. Davis, U. S. N	1846.
Do............	.....do	180	1-10,000	.....do	1846.
Do............	.....do	1877	1-5,000	S. C. Paine, U. S. N.........	1888.
Do............	Nantucket Sound, Nantucket Harbor, upper part....	1163	1-20,000	F. D. Granger..............	1872.
Do............	Nantucket Sound, Nantucket Harbor to Great Point.	2168	1-10,000	H. L. Marindin............	1893.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Massachusetts	Nantucket Sound, Nantucket Harbor to Tuckernuck Island.	2209	1-10,000	H. L. Marindin............	1894.
Do............	Nantucket Island, off shore to eastward.............	2051	1-20,000	E. M. Hughes, U. S. N......	1890.
Do............	Nantucket Island, east shore, from Great Point to Sankaty Head.	2039	1-10,000	H. L. Marindin............	1890.
Do............	Nantucket Island, south shore, from Sankaty Head to Surfside.	2040	1-10,000	.....do....................	1890.
Do.......... ..	Nantucket Island, off shore, from Siasconsett to Surfside.	2052	1-20,000	E. M. Hughes, U. S. N......	1890.
Do............	Nantucket Island, off shore, south side..............	2041	1-40,000	.....do....................	1890.
Do............	Nantucket Island, south side.........................	445	1-40,000	H. S. Stellwagen, U. S. N..	1854.
Do............	Nantucket Island, south side, from Miaconitt Rip to Tuckernuck Island.	1942	1-20,000	J. F. Moser, U. S. N.........	1889.
Do............	Nantucket Island, south side, from Miaconitt Rip to Long Pond.	2093	1-10,000	H. L. Marindin............	1891.
Do............	Nantucket Island, south side, Great Neck...........	2094	1-10,000	... .do....	1891.
Do............	Nantucket Island and Marthas Vineyard Island.....	1941	1-40,000	J. F. Moser, U. S. N........	1889.
Do............	Muskegat Channel..................................	239	1-20,000	C. H. Davis, U. S. N., and C. H. McBlair, U. S. N.	1848-50.
Do......... ..	.....do..	1844	1-20,000	J. F. Moser, U. S. N........	1888.
Do............	Marthas Vineyard Island, south side.................	378	1-40,000	H. S. Stellwagen, U. S. N.	1853.
Do............	Marthas Vineyard Island, Edgartown Harbor and Cotamy Bay.	1126	1-10,000	H. Mitchell and J. M. Hawley, U. S. N.	1871-86.
Do............	Marthas Vineyard Island, Edgartown Harbor........	182	1-10,000	C. H. Davis, U. S. N........	1846.
Do............	Marthas Vineyard Island, Edgartown Harbor and east shore.	2210	1-10,000	H. L. Marindin............	1894.
Do............	Marthas Vineyard Island, south shore...............	2130	1-10,000	.....do....................	1892.
Do............	... .do..	2131	1-10,000	.....do....................	1892.
Do............	Marthas Vineyard Island, south shore and part of north shore, vicinity of Gay Head.	2132	1-10,000	.....do	1892.
Do.......... ..	Marthas Vineyard Island, south shore, Cotamy Bay.	2090	1-10,000	.....do....................	1891.
Do............	Vineyard Sound, Edgartown Harbor...........	222	1-20,000	C. H. Davis, U. S. N........	1846.
Do............	Vineyard Sound and part of Buzzards Bay	163	1-20,000	.....do....................	1845-46.
Do............	Vineyard Sound, Cape Poge to West Chop...........	1829	1-10,000	C. P. Perkins, U. S. N......	1887.
Do............	Vineyard Sound, l'Homme Dieu Shoal..............	455 b	1-10,000	W. H. Brownson, U. S. N..	1883-84.
Do............	Vineyard Sound, West Chop to Robinson Hole.......	1802	1-20,000	C. P. Perkins, U. S. N......	1887.
Do............	Vineyard Sound, Lackey Bay, Naushon Island.......	595	1-20,000	C. R. P. Rodgers, U. S. N...	1857.
Do...	Vineyard Sound, east entrance and southern approaches.	1802	1-20,000	C. P. Perkins, U. S. N......	1887.
Do............	Vineyard Sound, Holmes Hole......................	161	1-20,000	G. S. Blake, U. S. N........	1845.
Do............	Vineyard Sound, Vineyard Haven Harbor...........	1106	1-10,000	H. Mitchell................	1871.
Do............	Vineyard Sound, approaches to southern and western end.	1843	1-40,000	J. F. Moser, U. S. N........	1888.
Do............	Vineyard Sound, western approaches................	238	1-40,000	C. H. McBlair, U. S. N	1851.
Do............	Vineyard Sound, Block Island, Cuttyhunk, and Gay Head, off shore.	204	1-20,000	R. Bache and J. R. Goldsborough, U. S. N.	1847-48.
Do.......	Vineyard Island, Old Man and Lone Rock, in channel between No Mans Land and Marthas Vineyard Island.	344	1-20,000	C. H. McBlair, U. S. N.....	1852.
Do............	Vineyard Sound, Cuttyhunk, Gay Head, No Mans Land, and vicinity.	596	1-40,000	C. R. P. Rodgers and J. E. Pillsbury, U. S. N.	1857-86.
Massachusetts and Rhode Island.	Vineyard Sound and Narragansett Bay approaches..	1788	1-40,000	J. F. Moser, U. S. N........	1887.
Massachusetts	Buzzards Bay and Vineyard Sound..................	163	1-20,000	C. H. Davis, U. S. N.........	1845-46.
Do............	Buzzards Bay..	160	1-20,000	G. S. Blake, U. S. N........	1845.
Do.......	.....do..	159	1-20,000	.....do.....	1845.
Do............	Woods Hole..	1833	1-5,000	C. P. Perkins, U. S. N......	1887.
Do............	Sippican Harbor....................................	829	1-5,000	H. Mitchell................	1863.
Do............	.....do..........	826	1-5,000	.....do....................	1863.
Do............	New Bedford Harbor and approaches...............	158	1-20,000	G. S. Blake, U. S. N........	1845.
Do............	.....do............	2229, 2230, 2231	1-10,000	G. C. Hanus, U. S. N.......	1895.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Massachusetts	Sow and Pigs Reef, end of Cuttyhunk Island........	357	1-5,000	M. Woodhull, U. S. N......	1853.
Do............	Sow and Pigs Reef, proposed site for light-house	358	1-120	.....do	1853.
Do............	Turnipus Beach to Black Rock........................	1792	1-10,000	J. F. Moser, U. S. N	1887.
Do............	Westport Harbor......................................	155	1-10,000	G. S. Blake, U. S. N	1845.
Massachusetts and Rhode Island.	Narragansett Bay approaches........................	1788	1-40,000	J. F. Moser, U. S. N	1887.
Do............	Mishaum Point to Sakonnet Point....................	154	1-20,000	G. S. Blake, U. S. N	1844.
Do............	Turnipus Beach to Sachuest Point....................	1791	1-10,000	J. F. Moser, U. S. N	1887.
Rhode Island	Schuyler Ledge, off Sakonnet Point..................	1443	1-10,000	U. Sebree, U. S. N..........	1879.
Do............	Narragansett Bay.................................. ...	1787	1-40,000	J. F. Moser, U. S. N	1887.
Do............	Narragansett Bay approaches, Sakonnet Point to Point Judith.	153	1-20,000	G. S. Blake, U. S. N	1844.
Do............	Narragansett Bay approaches........................	206	1-20,000	G. S. Blake and J. R. Goldsborough, U. S. N.	1847-48.
Do............	Narragansett Bay approaches, Point Judith to Beavertail Light.	1789	1-10,000	J. F. Moser, U. S. N	1887.
Do...	Narragansett Bay approaches, Breton Point to Sachuest Point.	1790	1-10,000	.....do	1887.
Do............	Narragansett Bay, Sakonnet River....................	205	1-10,000	J. R. Goldsborough, U.S.N.	1848.
Do............	Narragansett Bay, Newport Harbor..................	785	1-10,000	H. Mitchell and F. P. Webber.	1865.
Do......	Narragansett Bay, Eastern Passage, measured mile for speed course.	1938	1-10,000	J. S. Pillsbury, U. S. N	1889.
Do............	Narragansett Bay, Newport Harbor..................	811	1-5,000	F. P. Webber..............	1865.
Do...........	Narragansett Bay, Coasters Island Harbor...........	1468	1-5,000	J. R. Bartlett and J. F. Moser, U. S. N.	1880-87.
Do............	Narragansett Bay, Dutch Island Harbor.............	786	1-10,000	H. Mitchell................	1862.
Do............	Narragansett Bay, Rose Island to Prudence Island...	787 *a*	1-10,000	.....do	1862.
Do...........	Narragansett Bay, Dutch Island Harbor (replotting of No. 786).	787 *b*	1-10,000	.....do	1862.
Do............	Narragansett Bay, The Brothers to Quonset Point..	992	1-10,000	F. P. Webber..............	1868.
Do............	Narragansett Bay, Patience Island to Quonset Point	939	1-10,000	.....do	1867-68.
Do............	Narragansett Bay, Greenwich Bay....................	940	1-5,000	.....do	1867.
Do............	Narragansett Bay, Prudence Island to Fall River...	792 *a*	1-20,000	W. P. Trowbridge.........	1861.
Do............	Narragansett Bay, Taunton River, vicinity Fall River	792 *b*	1-20,000	.....do	1861.
Do............	Narragansett Bay, Warren River....................	888	1-5,000	F. P. Webber..............	1866.
Do............	Narragansett Bay, Providence River, Prudence Island to Starvegoat Island.	880	1-10,000	.....do	1865.
Do............	Narragansett Bay, Starvegoat Island to Providence..	878	1-5,000	.....do....	1865.
Do............	Narragansett Bay, Providence River and Harbor, Fuller Rock to Providence.	1327 *a*	1-2,400	H. Mitchell................	1878.
Do	Narragansett Bay, Seekonk River....................	865	1-5,000	A. M. Harrison	1865.
Do............	Narragansett Bay, Seekonk River, Indian Point Bridge to Red Bridge.	1326	1-2,400	H. Mitchell...........	1874.
Do............	Narragansett Bay, Seekonk River, Indian Point Bridge to Red Bridge (current chart).	1327 *b*	1-2,400	.....do	1874.
Do............	Narragansett Bay, approaches east of Block Island..	162	1-40,000	G. S. Blake, U. S. N.........	1845.
Do............	Block Island, East Ground...........................	1312	1-20,000	J. S. Bradford.............	1874.
Do............	Point Judith.................	1529 *b*	1-10,000	W. H. Brownson, U. S. N...	1884.
Do............	Block Island Sound, Point Judith to Quonocontang Pond.	84	1-20,000	T. R. Gedney, U. S. N......	1839.
Do............	Block Island Sound, Quonocontang Pond to Wilderness Point.	86	1-20,000	.....do	1839.
Connecticut and New York.	Block Island Sound, Fishers Island to Plum Island..	87	1-20,000	.....do	1839.
Rhode Island	Block Island Sound, Point Judith to Gardiners Point.	1529 *a*	1-40,000	W. H. Brownson, U. S. N...	1882.
Do............	Block Island Sound, east coast......................	1396 *a*	1-10,000	C. M. Chester, U. S. N......	1878.
Do............	Block Island Sound, west coast......................	1396 *b*	1-10,000	.....do	1878.
Do............	Block Island, southwest ledge.................	1397	1-40,000	.....do	1878.
Connecticut..	Block Island Sound, north side, from Brightmans Pond to Great Gull Island.	91	1-20,000	T. R. Gedney, U. S. N......	1839.
New York.........	Montauk Point, Great Eastern Rock..................	780	1-20,000	T. S. Phelps, U. S. N........	1863.
Connecticut	Fishers Island Sound................................	96	1-20,000	G. S. Blake, U. S. N.:.......	1839.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Connecticut	Fishers Island Sound	97	1-10,000	G. S. Blake and R. Clover, U. S. N.	1839-82.
Do	Fishers Island Sound and Pawcatuck River	99	1-10,000	G. S. Blake, U. S. N	1839.
Do	Fishers Island Sound, Watch Hill to Lattimer Reef	1577 *a*	1-10,000	A. V. Wadhams, U. S. N	1883.
Do	Fishers Island Sound, Latimer Reef to Race Point Light-house.	1577 *b*	1-10,000	do	1883.
Do	Pawcatuck River, entrance to Marsh Point	98	1-10,000	G. S. Blake, U. S. N	1839.
Do	Reefs between Watch Hill and East Point, Fishers Island.	85	1-20,000	C. P. Patterson, U. S. N	1847.
Do	Stonington Harbor, examination, Middle Ground	1820	1-10,000	S. C. Paine, U. S. N	1888.
Do	Mystic River approaches	1526	1-10,000	R. Clover, U. S. N	1882.
Do	New London Harbor and approaches	1527	1-10,000	do	1882.
Do	New London Harbor, Franks Ledge	94	1-10,000	R. Bache, U. S. N	1847.
Do	New London Harbor, Black Ledge to Groton	93	1-10,000	G. S. Blake, U. S. N	1839.
Do	Thames River, New London to Gates Ferry	114	1-10,000	do	1839.
Do	Thames River, Naval Station to Norwich	1242	1-10,000	H. G. Ogden	1874.
Do	Thames River, off the Naval Station	1006	1-1,200	C. Junken	1869.
Do	Thames River, Rocky Point to Cregg Cove	115	1-10,000	G. S. Blake, U. S. N	1841.
Do	Long Island Sound, north shore, Mumford Cove to Griswold Island.	92	1-10,000	do	1839.
Do	Long Island Sound, north shore, Fishers Island to Oyster Pond Point.	92 *bis*	1-10,000	do	1839.
Do	Long Island Sound, north shore, Race Rock to Plum Gut.	1590 *a*	1-20,000	J. T. Sullivan, U. S. N	1883.
Do	Long Island Sound, north shore, Griswold Cove to Black Point.	42	1-10,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, Goshen Point to Hatchet Point.	1603 *a*	1-10,000	J. D. Keeler, U. S. N	1883.
Do	Long Island Sound, north shore, Hatchet Point to Cornfield Point.	1603 *b*	1-10,000	do	1883.
Do	Long Island Sound, Connecticut River, entrance to Elys Ferry.	233	1-10,000	J. R. Goldsborough, U. S. N.	1849.
Do	Long Island Sound, Connecticut River Bar	275	1-20,000	M. Woodhull, U. S. N	1851.
Do	do	276	1-10,000	do	1851.
Do	Long Island Sound, Connecticut River, Lyme to Deep River.	2032	1-10,000	W. I. Vinal	1890.
Do	Long Island Sound, Connecticut River, Deep River and East Haddam.	2033	1-10,000	do	1890.
Do	Long Island Sound, Connecticut River	2034	1-10,000	do	1890.
Do	Long Island Sound, Connecticut River, Middle Haddam to Cromwell.	2035	1-10,000	do	1890.
Do	Long Island Sound, Connecticut River, Cromwell to North Glastonbury.	2086	1-10,000	do	1891.
Do	Long Island Sound, Connecticut River, North Glastonbury to Farmington River.	2087	1-10,000	do	1891.
Do	Long Island Sound, north shore, Hatchet Point to Hammonasset Point.	39	1-20,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, Connecticut River entrance to Westbrook Harbor.	41	1-10,000	do	1838.
Do	Long Island Sound, north shore, Cornfield Point to Hammonasset Point.	1603 *c*	1-10,000	J. D. Keeler, U. S. N	1883.
Do	Long Island Sound, north shore, Westbrook Harbor to Hammonasset Beach.	38	1-10,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, Menunketesuck Point to Hammock Point.	1345	1-5,000	J. Hergesheimer	1877.
Do	Long Island Sound, north shore, Hammonasset Point to Johnson Point.	35	1-20,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, Hammonasset Beach to Hoadley Point.	37	1-10,000	do	1838.
Do	Long Island Sound, north shore, Hammonasset Point to Sachems Head.	1637 *a*	1-10,000	W. G. Cutler, U. S. N	1884.
Do	Long Island Sound, north shore, Sachems Head to Negro Head.	1637 *b*	1-10,000	do	1884.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hpdrographer.	Date.
Connecticut	Long Island Sound, north shore, Little Harbor to Mansfield Point.	34	1-10,000	G. S. Blake, U. S. N.	1838.
Do	Long Island Sound, north shore, Stratford Point to Jeffreys Point.	29	1-20,000	do	1838.
Do	Long Island Sound, north shore, Negro Head to Southwest Ledge Light-House.	1638 *a*	1-10,000	W. G. Cutler, U. S. N	1884.
Do	Long Island Sound, north shore, Southwest Ledge Light-House to Cedar Point.	1638 *b*	1-10,000	do	1884.
Do	Long Island Sound, north shore, New Haven Harbor.	32	1-10,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, New Haven Harbor entrance and Luddington Shoal.	647	1-5,000	W. G. Temple, U. S. N	1858.
Do	Long Island Sound, north shore, New Haven Harbor entrance to Charles Point.	28	1-10,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, Milford Haven (reconnaissance).	1428	1-10,000	E. P. Lull, U. S. N.	1878.
Do	Long Island Sound, north shore, New Haven Harbor.	1170 *a*	1-10,000	R. M. Bache	1872.
Do	Long Island Sound, north shore, New Haven Harbor, Townshend Ledge.	1170 *b*	1-10,000	F. H. Gerdes	1872.
Do	Long Island Sound, north shore, Quinnipiac River at Fair Haven.	33	1-10,000	G. S. Blake, U. S. N	1838.
Do	Long Island Sound, north shore, Charles Island to Black Rock Light.	23	1-10,000	do	1837.
Do	do	24	1-10,000	do	1837.
Do	Long Island Sound, north shore, Cedar Point to Stratford Point.	1735	1-10,000	S. C. Paine, U. S. N.	1885.
Do	Long Island Sound, north shore, Stratford Point to Bridgeport.	1736	1-10,000	do	1885.
Do	Long Island Sound, north shore, Bridgeport Bar and Harbor.	25	1-5,000	G. S. Blake, U. S. N.	1835.
Do	Long Island Sound, north shore, Black Rock Harbor.	1575	1-5,000	W. H. Brownson, U. S. N.	1883.
Do	Long Island Sound, north shore, Black Rock to Sheffield Light.	18	1-10,000	G. S. Blake, U. S. N	1835.
Do	Long Island Sound, north shore, Sheffield Light to Frost Point.	19	1-10,000	do	1835.
Do	Long Island Sound, north shore, Black Rock Light to Sherwood Point.	20	1-10,000	do	1835.
Do	Long Island Sound, north shore, Fairfield Bar to Cockenoes Island.	1750	1-10,000	S. C. Paine, U. S. N.	1885.
Do	Long Island Sound, north shore, Cockenoes Island to Sheffield Island.	1751	1-10,000	do	1885.
Connecticut and New York.	Long Island Sound, north shore, Sheffield Island to Oak Neck.	8 *bis*	1-10,000	G. S. Blake, U. S. N.	1836.
Connecticut	Long Island Sound, north shore, Sheffield Light to Great Captain Island.	9	1-10,000	do	1836.
Do	Long Island Sound, north shore, Sheffield Island to Stamford Light.	1698	1-10,000	D. D. V. Stuart, U. S. N.	1886.
Do	Long Island Sound, north shore, Stamford Light to Manursing Island.	1699	1-10,000	do	1886.
Do	Long Island Sound, north shore, Great Captain Island Harbor and Little Captain Island Harbor.	4	1-10,000	G. S. Blake, U. S. N	1836-37.
New York	Long Island Sound, north shore, Rye Neck to Davids Island.	1683	1-10,000	D. D. V. Stuart, U. S. N.	1886.
Do	Long Island Sound, north shore, Prospect Point to Throgs Neck.	1	1-10,000	G. S. Blake, U. S. N	1837.
Do	Long Island Sound, north shore, City Island Harbor.	1560 *b*	1-10,000	C. Hosmer	1883.
Do	Long Island Sound, north shore, Throgs Point to South and Blackwells Island.	67	1-10,000	T. R. Gedney and G. M. Bache, U. S. N.	1837-41.
Connecticut and New York.	Block Island Sound	1529 *a*	1-40,000	W. H. Brownson, U. S. N	1882.
Do	do	86	1-20,000	T. R. Gedney, U. S. N.	1839.
New York	Block Island Sound, Phelps Ledge and Great Eastern Rock.	780	1-20,000	T. S. Phelps, U. S. N.	1863.
Do	Block Island Sound, south shore, Montauk Point	1539	1-20,000	C. Hosmer	1882.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New York	Block Island Sound, south shore, Napeague Bay and Harbor.	88	1-40,000	C. H. Davis, U. S. N.	1845.
Do	Black Island Sound, south shore, Napeague Bay and Harbor, Montauk Point.	89	1-40,000	....do	1845.
Do	Block Island Sound, west end	87	1-20,000	T. R. Gedney, U. S. N.	1839.
Do	Block Island Sound, west end, and Long Island Sound, east end.	95	1-10,000	G. S. Blake, U. S. N.	1839.
Do	Block Island Sound, west end, Bedford Reef, Plum Island, Great Gull Island (compiled).	90	1-10,000	Gedney, Blake, and Davis, U. S. N.	1839-45.
Do	Plum Gut	1255	1-5,000	J. S. Bradford	1874.
Do	Gardiners Bay	80	1-20,000	T. R. Gedney, U. S. N.	1838.
Do	Gardiners Bay, Three Mile, and Napeague Harbor	1543	1-20,000	E. M. Hughes, U. S. N.	1882.
Do	Long Island Sound, south shore, Plum Island to Browns Hill.	43	1-10,000	G. S. Blake, U. S. N.	1838.
Do	Long Island Sound, south shore, Plum Island to Inlet Point.	1590 *b*	1-20,000	J. T. Sullivan, U. S. N.	1883.
Do	Greenport Harbor, Orient Bay, Southhold Bay	78	1-10,000	T. R. Gedney, U. S. N.	1838.
Do	Shelter Island Sound	1568	1-10,000	C. Hosmer	1883.
Do	Greenport Harbor and Southhold Bay	79	1-10,000	T. R. Gedney, U. S. N.	1838.
Do	Orient Harbor	81	1-10,000	....do	1839.
Do	Sag Harbor	82	1-10,000	....do	1839.
Do	Sag Harbor and vicinity	83	1-10,000	....do	1839.
Do	Shelter Island Sound, Sag Harbor and approaches	2082	1-10,000	W. P. Elliott, U. S. N.	1891.
Do	Shelter Island Sound, Noyack Bay, and eastern part of Little Peconic Bay.	2083	1-10,000	....do	1891.
Do	Great Peconic Bay and Little Peconic Bay	77	1-20,000	T. R. Gedney, U. S. N.	1838.
Do	Little Peconic Bay and entrance to Great Peconic Bay.	2097	1-10,000	W. P. Elliott, U. S. N.	1891.
Do	Great Peconic Bay, eastern part	2098	1-10,000	....do	1891.
Do	Great Peconic Bay, western part	2099	1-10,000	....do	1891.
Do	Long Island Sound, south shore, Mulfords Point to Mattituck Creek.	40	1-20,000	G. S. Blake, U. S. N.	1838.
Do	Long Island Sound, south shore, Inlet Point to Old Landing.	1591	1-40,000	J. T. Sullivan, U. S. N.	1883.
Do	Long Island Sound, south shore, Mattituck Creek to Herod Point.	36	1-20,000	G. S. Blake, U. S. N.	1838.
New York and Connecticut.	Long Island Sound, Falkner Island to Startford Shoal.	1733	1-40,000	F. H. Crosby, U. S. N.	1886.
Do	Long Island Sound, Stratford Shoal to Eatons Neck.	1731	1-40,000	....do	1886.
New York	Long Island Sound, Herod Point to Old Field Point.	30	1-20,000	G. S. Blake, U. S. N.	1838.
Do	Long Island Sound, Port Jefferson (part of No. 30)	31	1-10,000	....do	1838.
Do	Long Island Sound, Port Jefferson, Setauket Harbor, and Conscience Bay entrance.	1283 *a*	1-5,000	F. H. Gerdes	1874.
Do	Long Island Sound, Port Jefferson, Setauket Harbor, and Conscience Bay.	1283 *b*	1-10,000	....do	1874.
Do	Long Island Sound, south shore, Oldfield Point to Eatons Neck.	21	1-20,000	G. S. Blake, U. S. N.	1837.
Do	Long Island Sound, south shore, Port Jefferson Harbor and vicinity.	1734	1-10,000	F. H. Crosby, U. S. N.	1886.
Do	Long Island Sound, south shore, Oldfield Point to Nissequague River.	26	1-10,000	G. S. Blake, U. S. N.	1837.
Do	Long Island Sound, south shore, Stony Brook and vicinity.	27	1-10,000	....do	1837.
Do	Long Island Sound, south shore, Smithton Bay	1709	1-10,000	W. J. Sears, U. S. N.	1886.
Do	Long Island Sound, south shore, Nissequague Point to Eaton Point.	22	1-10,000	G. S. Blake, U. S. N.	1837.
Do	Long Island Sound, south shore, Eaton Point to Oak Neck.	10	1-10,000	....do	1837.
Do	Long Island Sound, south shore, Eaton Point to Execution Rock.	1732	1-20,000	F. H. Crosby, U. S. N.	1886.
Do	Long Island Sound, south shore, Huntington Bay approaches.	1708	1-10,000	F. S. Carter and W. J. Sears, U. S. N.	1886.
Do	Long Island Sound, south shore, Huntington Bay, Northport Bay, Huntington and Lloyd harbors.	16	1-3,333	G. S. Blake, U. S. N.	1837.

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New York	Long Island Sound, south shore, Huntington Bay, Huntington and Lloyd harbors.	17	1-20,000	G. S. Blake, U. S. N.	1836-37.
Do	Long Island Sound, south shore, Huntington Bay	1707	1-10,000	F. S. Carter and W. J. Sears, U. S. N.	1886.
Do	Long Island Sound, south shore, Northport Bay	15	1-10,000	G. S. Blake, U. S. N.	1837.
Do	Long Island Sound, south shore, Oyster Bay, Oyster Bay Harbor, and Cold Spring Harbor.	11	1-10,000	do	1836-37.
Do	do	12	1-10,000	do	1836-37.
Do	do	13	1-3,333	do	1836-37.
Do	do	14	1-3,333	do	1836-37.
Do	Long Island Sound, south shore, Oyster Bay	1710	1-10,000	F. S. Carter, U. S. N.	1886.
Connecticut and New York.	Long Island Sound, west end, Greenwich Point to Baker Point.	4	1-10,000	G. S. Blake, U. S. N.	1836-37.
Do	Long Island Sound, west end, Little Captain Island to Baker Point.	5	1-10,000	do	1836-37.
New York	Long Island Sound, south shore, Matinicock Point to Willets Point.	3	1-10,000	do	1836-37.
Do	Long Island Sound, south shore, Hempstead Harbor.	7	1-10,000	do	1836-37.
Do	do	692	1-10,000	T. B. Huger, U. S. N.	1859.
Do	do	1700	1-10,000	D. D. V. Stuart, U. S. N.	1886.
Do	Long Island Sound, west end, Elm Point to Sands Point.	1560 *a*	1-10,000	C. Hosmer	1883.
Do	Long Island Sound, west end, Whortleberry Island to Hewlett Point.	2	1-10,000	G. S. Blake, U. S. N	1837.
Do	Long Island Sound, west end, Little Neck Bay and East River from Throgs Neck to College Point.	1569	1-10,000	C. Hosmer	1883.
Do	Long Island, Montauk Point, speed-trial course of U. S. S. Philadelphia.	2020	1-80,000	C. E. Vreeland, U. S. N.	1890.
Do	Long Island, Montauk Point to Napeague	253	1-40,000	M. Woodhull, U. S. N.	1851.
Do	Long Island, Montauk Point to Shinnecock Bay	74	1-20,000	T. R. Gedney, U. S. N.	1838.
Do	Long Island, Montauk Point to west end of Shinnecock Bay.	75	1-20,000	do	1838.
Do	Long Island, Montauk Point to east end of Shinnecock Bay.	76	1-40,000	do	1838.
Do	Long Island, Napeague Harbor to Quantuck Bay	232	1-40,000	M. Woodhull, U. S. N.	1850.
Do	Long Island, Shinnecock Bay to Bellport Bay	73	1-40,000	T. R. Gedney, U. S. N.	1838.
Do	Long Island, Mecox Bay and Georgica Pond	2123	1-10,000	C. T. Iardella	1891.
Do	Long Island, Shinnecock Bay, east end	2031	1-10,000	do	1890.
Do	Long Island, Shinnecock Bay to Fire Island Beach	72	1-20,000	T. R. Gedney, U. S. N	1838.
Do	Long Island, Quantuck Bay to Gilgo Inlet	203	1-40,000	R. Bache, U. S. N.	1848.
Do	Long Island, Quantuck Bay and Moriches Bay, east end.	2030	1-10,000	C. T. Iardella	1890.
Do	Long Island, Moriches Bay, west end	2068	1-10,000	do	1891.
Do	Long Island, Fire Island Inlet	48	1-10,000	T. R. Gedney, U. S. N.	1834-35.
Do	Long Island, Fire Island Inlet and part of Great South Bay.	1198 *a*	1-20,000	C. Hosmer	1873.
Do	Long Island, Fire Island Inlet Bar	1851	1-10,000	W. H. Dennis	1887.
Do	Long Island, Great South Bay, Conklin Point to Greens Point.	44	1-10,000	T. R. Gedney, U. S. N.	1834.
Do	do	45	1-20,000	do	1834.
Do	Long Island, Great South Bay, Nicolls Point to Howell Point.	1198 *b*	1-20,000	C. Hosmer	1874.
Do	Long Island, Great South Bay, Browns Point to Bellport Point.	46	1-20,000	T. R. Gedney, U. S. N	1835.
Do	Long Island, Great South Bay, Howell Point to East Bay entrance, and Bellport Bay.	1281	1-10,000	C. T. Iardella	1875.
Do	Long Island, Great South Bay and South Oyster Bay.	1481 *a*	1-10,000	J. W. Donn	1880.
Do	Long Island, Fire Island Beach to Coney Island	47	1-40,000	T. R. Gedney, U. S. N.	1835.
Do	Long Island, Gilgo Inlet	49	1-10,000	do	1835.
Do	Long Island, New Inlet	50	1-10,000	do	1835.
Do	Long Island, Hempstead Bay, New and Jones inlets	1481	1-10,000	J. W. Donn	1880.
Do	Long Island, Hempstead Bay, Far Rockaway Bay to Luci Inlet.	1437	1-10,000	do	1879.
Do	Long Island, off Rockaway Beach	51	1-20,000	T. R. Gedney, U. S. N.	1835.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New York....	Long Island, Rockaway Bay and Jamaica Bay entrance.	129	1-10,000	G. M. Bache, U. S. N.......	1841.
Do............	Long Island, Rockaway Inlet and Bar...............	1359	1-5,000	W. Maynard and E. B. Thomas, U. S. N.	1877-81.
Do............	Long Island, Rockaway Inlet.......................	1834	1-10,000	J. Hergesheimer..........	1888.
Do............	Long Island, Jamaica Bay, western part, and Canarsie Landing.	1358	1-5,000	W. Maynard, U. S. N......	1877,
Do............	Long Island, Jamaica Bay, eastern part..............	1392	1-10,000	W. I. Moore, U. S. N.......	1878.
Do............	Long Island, Jamaica Bay, Cornell and Mill Creek...	1494	1-2,400	J. W. Donn...............	1880.
New York and New Jersey.	New York Harbor approaches, Rockaway to Sandy Hook.	54	1-20,000	T. R. Gedney, U. S. N......	1840.
Do............	New York Harbor approaches, Rockaway to Sandy Hook (copy of part of No. 54).	56	1-5,000	.....do	1840.
Do............	New York Harbor approaches........................	526	1-20,000	T. A. Craven, U. S. N.......	1855-56.
Do............	New York Harbor approaches, South and North Channel.	55	1-5,000	T. R. Gedney, U. S. N......	1840.
Do............	New York Harbor approaches.......................	1578 *a*	1-40,000	H. B. Mansfield, U. S. N...	1883.
Do............	.....do..	1578 *b*	1-80,000	.....do....................	1883.
Do............	New York Harbor entrance, Sandy Hook Bar........	53	1-10,000	T. R. Gedney, U. S. N......	1835.
Do............	New York Harbor entrance, Sandy Hook Bar (part of No. 53).	57	1-10,000	.....do....................	1835.
Do............	New York Harbor entrance, Sandy Hook Bar........	52	1-10,000	.....do....................	1835.
Do............	New York Harbor, Romer and Flynns knolls, East and West Swash channels.	356	1-20,000	M. Woodhull, U. S. N......	1853.
Do............	New York Harbor entrance, South Gedney and East channels.	207	1-10,000	R. Bache, U. S. N..........	1848.
New Jersey.......	New York Harbor entrance, channel between Sandy Hook, Flynns Knoll and Scotland Shoal.	1009	1-20,000	F. F. Nes..................	1869.
New York.........	New York Harbor entrance, South and Gedney channels.	1663	1-10,000	G. C. Hanus, U. S. N.......	1885.
Do............	New York Harbor entrance (tracing)................	1506	1-10,000	E. B. Thomas, U. S. N......	1881-82.
New Jersey.......	New York Harbor entrance, off Sandy Hook.........	1718	1-20,000	G. C. Hanus, U. S. N.......	1896.
New York and New Jersey.	New York Harbor entrance, Sandy Hook Bar, Raritan and Newark bays, and Staten Island Sound.	62	1-20,000	T. R. Gedney, U. S. N......	1836.
Do............	New York Harbor entrance, Sandy Hook, around point.	784 *a*	1-5,000	H. Mitchell................	1863.
Do............	New York Harbor entrance, Sandy Hook (within No. 784 *a*).	784 *b*	1-5,000	F. F. Nes..................	1873.
New Jersey	New York Harbor entrance, False Hook and False Hook Channel.	769	1-20,000	A. Murray, U. S. N.........	1860.
New York and New Jersey.	New York Harbor, Lower Bay, Sandy Hook and Raritan bays, Arthur Kills, and Kill van Kull.	61	1-10,000	T. R. Gedney, U. S. N......	1836.
New York.........	New York Harbor, Lower Bay, Swash Channel.......	897 *a*	1-20,000	W. S. Edwards............	1866.
Do............	New York Harbor, Lower Bay, shoals near Sandy Hook.	897 *b*	1-20,000	F. F. Nes..................	1872.
Do............	New York Harbor, Lower Bay	1662	1-10,000	G. C. Hanus, U. S. N	1885.
Do............	New York Harbor, Lower Bay, Gedney and Swash channels.	1601	1-10,000	J. M. Orchard, U. S. N	1884.
Do............	New York Harbor, Lower Bay, Swash Channel (compiled).	1564	1-10,000	....	1879-81.
Do............	New York Harbor, Lower Bay, Sandy Hook to Fort Tompkins.	1275	1-20,000	F. F. Nes..................	1872-73-74.
Do............	New York Harbor, Lower Bay.........................	1189	1-20,000	.....do....................	1872.
Do............	.....do	1661	1-20,000	G. C. Hanus, U. S. N	1885.
Do............	New York Harbor, Lower Bay, Dumping Ground....	1145 *b*	1-10,000	H. L. Marindin............	1872.
Do............	New York Harbor, Lower Bay, bulkhead of West Bank Channel (compiled).	1962	1-10,000	T. A. Craven, U. S. N., and F. F. Nes.	1855-56-74.
Do............	New York Harbor, Lower Bay, Gravesend Bay.......	59	1-20,000	G. M. Bache and R. C. Walsch, U. S. N.	1841.
Do............	.....do..	128	1-10,000	G. M. Bache, U. S. N.......	1841.
Do............	New York Harbor, Lower Bay and Narrows..........	1664	1-10,000	G. C. Hanus, U. S. N	1885.
Do............	New York Harbor, Narrows..........................	1175	1-10,000	F. F. Nes	1872.
Do............	.....do..	63	1-10,000	T. R. Gedney, U. S. N......	(?)

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New York	New York Harbor, Upper Bay	1719	1-5,000	G. C. Hanus, U. S. N	1886.
New York and New Jersey.	New York Harbor, Upper Bay and Kill van Kull	1667	1-10,000	W. G. Cutler, U. S. N	1885.
Do	New York Harbor, Upper Bay, Jersey Flats and Governors Island.	1145 *a*	1-10,000	H. L. Marindin	1871-72.
New York	New York Harbor, Upper Bay, East River to Suspension Bridge.	1660	1-5,000	J. M. Hawley, U. S. N	1885.
Do	New York Harbor, Upper Bay, Ellis Island and vicinity.	2005	1-2,500	W. P. Elliott, U. S. N	1890.
Do	New York Harbor, Upper Bay, Ellis Island and vicinity, Dredged Channel.	2140	1-2,500	C. E. Vreeland, U. S. N	1892.
Do	New York Harbor, Upper Bay, Fort Tompkins to Bedloe Island.	490	1-10,000	T. A. Craven, U. S. N	1855.
Do	New York Harbor, Upper Bay, Robbins Reef Light to Governors Island.	970	1-10,000	F. H. Gerdes	1868.
Do	do	783	1-10,000	T. R. Phelps, U. S. N	1863.
New Jersey	New York Harbor, Upper Bay, Jersey Flats	423	1-10,000	M. Woodhull, U. S. N	1853.
New York	New York Harbor, Upper Bay, East River	1968	1-10,000	F. F. Nes	1872.
Do	New York Harbor, Upper Bay (dynamic chart)	1977	1-10,000	H. L. Marindin	1872-75.
Do	New York Harbor, Upper Bay, Gowanus Bay	1209	1-10,000	F. F. Nes	1872.
New York and New Jersey.	New York Harbor, Upper Bay, Kill van Kull	492	1-10,000	R. Wainwright, U. S. N	1855.
Do	New York Harbor, Upper Bay, Communipaw Flats, Gowanus Bay, and Buttermilk Channel.	130	1-10,000	G. M. Bache, U. S. N	1841.
New York	New York Harbor, Upper Bay, Buttermilk Channel	208	1-5,000	D. D. Porter, U. S. N	1848.
Do	New York Harbor, Upper Bay, Diamond and Princess reefs.	226	1-2,500	M. Woodhull, U. S. N	1850.
New York and New Jersey.	New York Harbor and vicinity, North and East rivers.	460	1-10,000	do	1854.
New York	New York Harbor, Diamond and Coenties reefs	497	1-20,000	T. A. Craven, U. S. N	1855.
Do	New York Harbor, off the Battery	678	1-5,000	do	1859.
Do	New York Harbor, Princess and Coenties reefs	697	1-5,000	J. Wilkinson, U. S. N	1859.
Do	New York Harbor, Diamond Reef	698	1-5,000	do	1859.
Do	do	748	1-2,500	T. S. Phelps, U. S. N	1861.
Do	do	1580	1-5,000	H. B. Mansfield, U. S. N	1884.
Do	New York Harbor, off the Battery	910	1-2,500	W. S. Edwards	1867.
Do	New York Harbor, off the Battery, Reported Rock	1950	1-2,500	W. P. Elliott, U. S. N	1890.
Do	New York Harbor (current chart)	1981	1-10,000	F. F. Nes, H. L. Marindin, and J. B. Weir.	1872-73.
Do	New York Harbor, East River, Governors Island to northeast end of Blackwells Island.	491 *a*	1-10,000	T. A. Craven, U. S. N	1855.
Do	New York Harbor, East River, Governors Island to northeast end of Blackwells Island (copy of 491 *a*).	491 *b*	1-10,000	do	1855.
Do	New York Harbor, East River, off Nineteenth street.	491 *c*	1-10,000	F. F. Nes	1873.
Do	New York Harbor, East River, Governors Island to Blackwells Island.	66	1-10,000	T. R. Gedney, U. S. N	1837.
Do	New York Harbor, East River, Blackwells Island to Throgs Neck.	67	1-10,000	T. R. Gedney and G. M. Bache, U. S. N.	1837-41.
Do	New York Harbor, East River, Hell Gate to Throgs Neck.	580	1-10,000	T. A. Craven, U. S. N	1856.
Do	New York Harbor, East River, Rickers Island and vicinity.	580 *a*	1-10,000	W. H. Brownson, U. S. N	1883.
Do	New York Harbor, East River, Suspension Bridge to south end of Blackwells Island.	1659	1-5,000	J. M. Hawley, U. S. N	1885.
Do	New York Harbor, East River, channels from south end of Blackwells Island to Astoria.	1658	1-2,500	do	1885.
Do	New York Harbor, East River, Lawrence Point to College Point and Flushing Bay.	1703	1-5,000	C. P. Perkins, U. S. N	1886.
Do	New York Harbor, East River and Upper Bay, Fulton Ferry to Bay Ridge.	1968	1-10,000	F. F. Nes	1872.
Do	New York Harbor, East River, Battery to Blackwells Island (dynamic chart).	1978	1-10,000	H. L. Marindin and J. B. Weir.	1872-75.
Do	New York Harbor, East River and Blackwells Island Channel (dynamic chart).	1979	1-10,000	do	1872-75.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New York	New York Harbor, East River, Wallabout Bay	1065	1-1, 250	F. F. Nes	1869.
Do	....do	1994	1-2, 500	W. P. Elliott, U. S. N	1890
Do	New York Harbor, East River, Hell Gate	224	1-2, 500	D. D. Porter, U. S. N	1848.
Do	New York Harbor, East River, Hell Gate and approaches.	645	1-5, 000	T. A. Craven, U. S. N	1856.
Do	New York Harbor, East River, Hell Gate, Frying Pan, and Pot Rocks.	896	1-1, 200	W. S. Edwards	1866.
Do	New York Harbor, East River, Hell Gate and vicinity.	1704	1-2, 500	C. P. Perkins, U. S. N	1886.
Do	New York Harbor, East River, Hell Gate (hydrographic sketch).	1974	1-5, 000	D. D. Porter, U. S. N	1848.
Do	New York Harbor, East River, Hell Gate (course and velocity of tide).	1975	1-18, 320	C. H. Davis, U. S. N	1845.
Do	New York Harbor, East River, Hell Gate (current chart).	1976	....	....do	1845.
Do	New York Harbor, East River, Harlem River and Little Hell Gate.	225	1-2, 500	M. Woodhull, U. S. N	1849.
Do	New York Harbor, Harlem River, Spuyten Duyvil Creek, Harlem Bridge to Hudson River.	646	1-10, 000	T. A. Craven, U. S. N	1856.
Do	New York Harbor, Harlem River, Randalls Island to High Bridge.	1702	1-5, 000	C. P. Perkins, U. S. N	1886.
Do	New York Harbor, Harlem River, Spuyten Duyvil Creek, Hudson River, High Bridge to Kings Bridge.	1705	1-5, 000	....do	1886.
New York and New Jersey.	New York Harbor, Governors Island to West Hoboken.	1181	1-10, 000	H. L. Marindin	1873.
Do	New York Harbor, Battery to Castle Point	1668	1-5, 000	W. G. Cutler, U. S. N	1885.
Do	New York Harbor, Castle Garden to Long Dock	70	1-5, 000	T. R. Gedney, U. S. N	1837.
Do	New York Harbor, Castle Garden to Jeffreys Hook	71	1-10, 000	....do	1837.
Do	New York Harbor, Castle Garden to Guttenberg	477	1-10, 000	R. Wainwright, U. S. N	1855.
Do	New York Harbor, Battery to Seventy-ninth street (dynamic chart).	1980	1-10, 000	H. L. Marindin and J. B. Weir.	1872-75.
Do	Hudson River, Castle Point to Bulls Ferry	1699	1-5, 000	W. G. Cutler, U. S. N	1885.
Do	Hudson River, Guttenberg to Spuyten Duyvil	68	1-5, 000	T. R. Gedney, U. S. N	1837.
Do	Hudson River, Manhattanville to Spuyten Duyvil Creek (copy of No. 68).	69	1-5, 000	....do	1837.
Do	Hudson River, Guttenberg to beyond Jeffreys Hook	496	1-10, 000	R. Wainwright, U. S. N	1855.
Do	Hudson River, Bulls Ferry to One hundred and forty-first street.	1670	1-5, 000	W. G. Cutler, U. S. N	1885.
Do	Hudson River, One hundred and forty-first street to Tubby Hook.	1701	1-5, 000	C. P. Perkins, U. S. N	1886.
Do	Hudson River, Jeffreys Hook to Hastings	408	1-10, 000	R. Wainwright, U. S. N	1853.
Do	Hudson River, Tubby Hook to Spuyten Duyvil, Harlem River.	1705	1-5, 000	C. P. Perkins, U. S. N	1886.
Do	Hudson River, Tubby Hook to Yonkers	475	1-10, 000	R. Wainwright, U. S. N	1855.
New York	Hudson River, Hastings to Nyack	409	1-10, 000	....do	1854.
Do	Hudson River, Nyack to Teller Point	410	1-10, 000	....do	1854.
Do	Hudson River, Teller Point to Cauldwells	458	1-10, 000	....do	1854.
Do	Hudson River, Cauldwells to Fort Montgomery	459	1-10, 000	....do	1854.
Do	Hudson River, Fort Montgomery to Buttermilk Falls.	630	1-5, 000	J. H. Moore, U. S. N	1857.
Do	Hudson River, Buttermilk Falls to Stony Point	631	1-5, 000	....do	1857.
Do	Hudson River, Stony Point to Balmville	632	1-10, 000	....do	1857.
Do	Hudson River, Sherman Dock to Old Lime Kiln	729	1-10, 000	C. M. Fauntleroy, U. S. N	1859.
Do	Hudson River, Old Lime Kiln to New Paltz	730	1-10, 000	....do	1859.
Do	Hudson River, New Paltz to Indian Rock	735	1-10, 000	....do	1859.
Do	Hudson River, Indian Rock Ice House Wharf, Rhinebeck.	736	1-10, 000	....do	1860.
Do	Hudson River, Rondout Creek	665	1-5, 000	A. Murray, U. S. N	1858.
Do	Hudson River, Rondout Harbor, entrance to Sleights Ferry.	979	1-1, 250	F. F. Nes	1868.
Do	Hudson River, Rondout Harbor, Sleights Ferry to entrance Delaware and Hudson Canal.	978	1-2, 500	....do	1868.
Do	Hudson River, Ice House Wharf, Rhinebeck, to Glasco.	752	1-10, 000	J. Mechan	1861.
Do	Hudson River, Glasco to Tivoli	753	1-10, 000	....do	1861.
Do	Hudson River, Esopus Creek	666	1-5, 000	A. Murray, U. S. N	1858.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New York	Hudson River, Tivoli to Upper Coal Beds Light	798	1–10,000	J. Mechan	1862.
Do	Hudson River, Upper Coal Beds Light to Percy Reach Light.	799	1–10,000	....do	1862.
Do	Hudson River, Percy Reach Light to Coxsackie	800	1–10,000	....do	1862–63.
Do	Hudson River, Coxsackie to Houghtailing Island	844	1–10,000	A. Strausz	1863.
Do	Hudson River, New Baltimore to Albany	549	1–5,000	R. Wainwright, U.S.N	1856.
Do	Hudson River, Albany to Troy	843	1–10,000	A. Strausz	1863.
Vermont	Lake Champlain, Canadian boundary to Butler Island.	1182	1–20,000	C. Junken	1873.
Vermont and New York.	Lake Champlain, Canadian boundary to Isle La Motte Light.	1173	1–10,000	....do	1873.
Do	Lake Champlain, Isle La Motte Light to Cumberland Head Light.	1151	1–20,000	Junken, Wright, and Hergesheimer.	1872.
Vermont	Lake Champlain, Butler Island to Sand Bar Bridge	1162	1–20,000	L. B. Wright	1873.
Vermont and New York.	Lake Champlain, Cumberland Head to Valcour Island.	1058	1–20,000	C. Junken	1870.
Do	Lake Champlain, Valcour Island to Trembleau Point.	1118 *a*	1–20,000	F. D. Granger	1871.
Vermont	Lake Champlain, Colchester and Hogsback reefs, (part of 1118 *a*).	1118 *b*	1–10,000	....do	1871.
Vermont and New York.	Lake Champlain, Trembleau Point to Ligonier Point.	1119	1–20,000	....do	1871.
Vermont	Lake Champlain, Burlington Harbor	1105	1–10,000	....do	1871.
Vermont and New York.	Lake Champlain, Shelburn and Willsborough bays	1246 *b*	1–10,000	C. Junken	1874.
Do	Lake Champlain, Four Brothers to Rock Harbor	1244 *a*	1–20,000	L. B. Wright	1873.
Do	Lake Champlain, Rock Harbor to Crown Point Light.	1244 *b*	1–20,000	....do	1873.
Do	Lake Champlain, Crown Point Light to Crown Point Landing.	1246 *a*	1–10,000	C. Junken	1874.
Do	Lake Champlain, Crown Point Landing to Laribee Landing.	1247 *a*	1–10,000	....do	1874.
Do	Lake Champlain, Laribee Landing to Benson Landing.	1247 *b*	1–10,000	....do	1874.
Do	Lake Champlain, Benson Landing to Light Beacon No. 9.	1248 *a*	1–10,000	....do	1874.
Do	Lake Champlain, Light Beacon No. 9 to Whitehall, including South Bay.	1248 *b*	1–10,000	....do	1874.
New York and New Jersey.	Raritan Bay, with Sandy Hook Bar, Staten Island Sound, and Newark Bay.	62	1–20,000	T. R. Gedney, U. S. N	1836.
Do	Raritan Bay, with Sandy Hook Bay, Newark Bay, Arthur Kills, and Kill van Kull.	61	1–10,000	....do	
New York	Raritan Bay, with Great Kills and Staten Island, from Elm Tree Light to Seguine Point.	127	1–10,000	G. M. Bache, U. S. N	1841.
New Jersey	Raritan Bay, Sandy Hook to Perth Amboy	126	1–10,000	....do	1841.
New York and New Jersey.	....do	1712	1–20,000	G. C. Hanus, U. S. N	1886.
Do	Raritan Bay, Seguine Point to South Amboy	572	1–20,000	T. A. Craven, U. S. N	1857.
New Jersey	Raritan Bay, Middletown Creek	58	1–10,000	G. M. Bache, U. S. N	1841.
Do	Raritan River, mouth to Marsh Island	1172	1–5,000	F. H. Gerdes	1872.
Do	Raritan River, Marsh Island to city of Brunswick	1204	1–5,000	....do	1873.
Do	Raritan River, South River	1205	1–5,000	....do	1873.
New York and New Jersey.	Raritan Bay, Arthur Kills	64	1–10,000	T. R. Gedney, U. S. N	1836.
Do	Raritan Bay and Newark Bay, lower part	1716	1–5,000	G. C. Hanus, U. S. N	1886.
Do	Raritan Bay, Perth Amboy to Elizabethport	495	1–10,000	R. Wainwright, U. S. N	1855.
Do	Raritan Bay, Arthur Kills, Ward Point to Woodbridge Creek.	1713	1–5,000	G. C. Hanus, U. S. N	1886.
Do	Raritan Bay, Arthur Kills, Woodbridge Creek to Fresh Kills.	1714	1–5,000	....do	1886.
Do	Raritan Bay, Arthur Kills, Elizabethport to Newark Bay entrance.	494	1–10,000	R. Wainwright, U. S. N	1855.
Do	Raritan Bay, Arthur Kills, Fresh Kills to Dividing Creek.	1715	1–5,000	G. C. Hanus, U. S. N	1886.
New Jersey	Newark Bay	493	1–10,000	R. Wainwright, U. S. N	1855–56.
Do	Newark Bay (replotting of No. 493)	547	1–10,000	....do	1855–56.
Do	Newark Bay, lower part, to Passaic Light	1166 *b*	1–10,000	F. H. Gerdes	1871–72.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New Jersey	Newark Bay, Passaic Light to head of bay	1166 *a*	1-5,000	F. H. Gerdes	1871-72.
Do	Newark Bay, New Jersey Central Railroad Bridge to head of bay.	1717	1-10,000	G. C. Hanus, U. S. N	1886.
Do	Passaic River Bar	65	1-5,000	T. R. Gedney, U. S. N	1836.
Do	Passaic River, Morris Turnpike Bridge to bridge 1 mile above Newark.	1167	1-5,000	F. H. Gerdes	1871.
Do	Passaic River and Hackensack River to New Jersey Railroad Bridge.	1706	1-10,000	C. P. Perkins, U. S. N	1886.
Do	Hackensack River, Morris Canal to Upper Bridge	131	1-10,000	G. M. Bache, U. S. N	1841.
Do	Hackensack River, New Jersey Railroad Bridge to Erie Railroad Bridge.	1282	1-5,000	F. H. Gerdes	1871.
Do	Hackensack River, Delaware and Lackawanna Railroad Bridge to Hackensack Bridge.	*1398 *b*	1-10,000	....do	1872-74.
Do	Hackensack River, English Creek	1398 *c*	1-10,000	....do	1873-74.
New York and New Jersey.	New York Harbor approaches	1538	1-40,000	E. B. Thomas, U. S. N	1882.
New Jersey	Sandy Hook to Barnegat	106	1-40,000	T. R. Gedney, U. S. N	1840.
Do	Sandy Hook to Long Branch (part of No. 106)	103	1-20,000	....do	1840.
Do	Long Branch to Metedeconk River (part of No. 106)	104	1-20,000	....do	1840.
Do	Metedeconk River to Barnegat (part of No. 106)	105	1-20,000	....do	1840.
Do	Long Branch to Barnegat Inlet (part of No. 106)	102	1-20,000	....do	1840.
Do	Shrewsbury Rocks	1278	1-10,000	H. O. Handy, U. S. N	1875.
Do	Shrewsbury and Navesink rivers	107	1-10,000	G. M. Bache, U. S. N	1840.
Do	Shrewsbury and Navesink rivers (copy of No. 107)	60	1-10,000	....do	1840.
Do	Barnegat Bay and Inlet and Toms River	108	1-10,000	....do	1840.
Do	Barnegat Inlet	883	1-10,000	C. Fendall	1866.
Do	Barnegat Bay and Toms River	1317	1-20,000	J. F. Moser, U. S. N	1876.
Do	Barnegat Bay	1197 *b*	1-20,000	W. I. Vinal	1874.
Do	Barnegat Light-House to New Inlet	111	1-20,000	T. R. Gedney, U. S. N	1841.
Do	Barnegat Light-House to New Inlet (copy of No. 111).	112	1-40,000	....do	1841.
Do	Barnegat Light-House to Tuckers Beach	113	1-20,000	....do	1847.
Do	Tucker Beach to Cape May	116	1-40,000	G. S. Blake, U. S. N	1843.
Do	New Inlet and Little Egg Harbor entrance	109	1-10,000	G. M. Bache, U. S. N	1840.
Do	....do	110	1-10,000	....do	1840.
Do	....do	1158 *a*	1-10,000	W. I. Vinal	1872.
Do	....do	1158 *b*	1-10,000	....do	1874.
Do	Little Egg Harbor	1196	1-10,000	....do	1873.
Do	Little Egg Harbor and Manahawkin Bay	1197 *a*	1-10,000	....do	1873.
Do	Great Bay	1125	1-10,000	W. W. Harding	1871.
Do	Mullica River	1159	1-10,000	W. I. Vinal	1872.
Do	Great Egg Harbor, upper part	2116	1-20,000	E. E. Haskell	1891.
Do	Great Egg Harbor and adjacent waters	2054	1-20,000	R. A. Marr and E. E. Haskell.	1891.
Do	Brigantine Inlet and adjacent waters	1165	1-10,000	W. I. Vinal	1872.
Do	Absecom Inlet	837	1-10,000	T. S. Phelps, U. S. N	1864.
Do	Absecom Inlet and adjacent waters	1160	1-10,000	W. I. Vinal	1872.
Do	Peck Beach to Hereford Inlet	1696	1-40,000	J. E. Pillsbury, U. S. N	1886.
Do	Corsons Inlet to Leaming Sound, inland waters	2165	1-20,000	R. A. Marr and E. E. Haskell.	1891.
Do	Hereford Inlet and inland waters	2166	1-10,000	....do	1891.
Do	Richardson Sound to Cape Island Sound, inland waters.	2164	1-10,000	....do	1891.
New Jersey and Delaware.	Delaware Bay entrance, Five Fathom Bank to Capes May and Henlopen.	117	1-40,000	T. R. Gedney, U. S. N	1841.
New Jersey	Delaware Bay entrance, off Cape May	1533	1-40,000	H. Osterhaus, U. S. N	1882.
New Jersey and Delaware.	Delaware Bay entrance, off Cape May and Cape Henlopen.	151	1-40,000	G. S. Blake, U. S. N	1844.
Do	Delaware Bay entrance, Hen and Chickens Shoal and part of Five Fathom Bank.	1633	1-40,000	G. C. Hanus, U. S. N	1884.
Delaware	Delaware Bay entrance, Hen and Chickens Shoal	149	1-20,000	G. S. Blake, U. S. N	1844.
New Jersey and Delaware.	Delaware Bay entrance and River to Trenton (compiled).	148	1-80,000	....do	1841-42-43.

*Topographic number.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New Jersey	Delaware Bay entrance, Middle and South Shoals	125	1-20,000	R. Bache, U. S. N.	1847.
Do	Delaware Bay entrance, off Cape May	1655	1-10,000	F. H. Crosby, U. S. N.	1885.
New Jersey and Delaware.	Delaware Bay, Capes to Fishing Creek and Clark Point.	118	1-20,000	G. S. Blake, U. S. N	1842-43.
Do	Delaware Bay, Capes to Mispillion Creek Light	119	1-20,000	.....do	1842.
Delaware	Delaware Bay, vicinity of Delaware Breakwater	801	1-3,600	C. P. Patterson	1863.
New Jersey and Delaware.	Delaware Bay, Round Shoal to Brown Shoal	1566	1-20,000	G. C. Hanus, U. S. N	1883.
Do	Delaware Bay, Cape May and Cedar Beach to False Egg Island Point and Mahon River Light.	122	1-20,000	G. S. Blake, U. S. N	1842.
New Jersey	Delaware Bay, Crow Shoal (copy of part of No. 118)	120	1-20,000	.....do	1842.
Do	Delaware Bay, Crow Shoal and Cape May Roads	157	1-10,000	Compiled	1836-42. 1843-47.
New Jersey and Delaware.	Delaware Bay, Brown Shoal and Mispillion Creek to False Egg Island Point and Mahon River Light.	123	1-20,000	G. S. Blake, U. S. N	1842.
Do	Delaware Bay, Main Ship Channel, Brown Shoal to Swash Channel and Joe Flogger Shoal.	1476 *a*	1-20,000	E. B. Thomas, U. S. N.	1880.
New Jersey	Delaware Bay, southeastern part, Sea Grove, Cape May to Fishing Creek.	1632	1-20,000	G. C. Hanus, U. S. N	1884.
Delaware	Delaware Bay, Broad Kill to Mispillion Light and Lower, Middle, and Brown Shoals.	1582	1-20,000	.....do	1883.
New Jersey	Delaware Bay, Fishing Creek to Maurice River Light.	1678	1-20,000	F. H. Crosby, U. S. N.	1885.
Do	Delaware Bay, Maurice River Cove and Egg Island Flats.	1679	1-20,000	.....do	1885.
New Jersey and Delaware.	Delaware Bay, Duck, Mahon, and Cohansey Creeks and Maurice River.	121	1-20,000	G. S. Blake, U. S. N	1843.
New Jersey	Delaware Bay, Maurice River	1677	1-10,000	F. H. Crosby, U. S. N.	1885.
New Jersey and Delaware.	Delaware Bay, Fourteen Foot Bank and southern part of Joe Flogger Shoal.	1476 *b*	1-10,000	E. B. Thomas, U. S. N.	1880.
Delaware	Delaware Bay, Mispillion Creek to Murderkill Creek.	1631	1-20,000	G. C. Hanus, U. S. N	1884.
New Jersey and Delaware.	Delaware Bay and River, Jones Creek to Mahon River.	1581	1-20,000	H. B. Mansfield and C. McR. Winslow, U. S. N.	1882-83-85.
Do	Delaware Bay, Swash Channel, Joe Flogger Shoal to Ben Davis Point Shoal.	1475 *b*	1-20,000	E. B. Thomas, U. S. N.	1880.
Do	Delaware Bay, Main Ship Channel, Ben Davis Point Shoal to Ship John Shoal Light and Cohansey Creek approaches.	1475 *a*	1-20,000	.....do	1880.
Do	Delaware River, Cross Ledge to Ship John Shoal	124	1-20,000	G. S. Blake, U. S. N	1841.
Delaware	Delaware River, Mahon and Dona rivers	352	1-10,000	M. Woodhull, U. S. N	1852.
Do	Delaware River, Joe Flogger Shoal and Dona River	299	1-20,000	.....do	1852.
New Jersey and Delaware.	Delaware River, Mahon Ditch to Bombay Hook and Nantuxent Point to sea.	1544	1-20,000	H. L. Marindin	1882.
Do	Delaware River, Ben Davis Point to Liston Point	132	1-20,000	G. S. Blake, U. S. N	1841.
Do	Delaware River Channel from Ship John Shoal to Pea Patch Island.	1249 *a*	1-20,000	F. F. Nes	1875.
Do	Delaware River, Cohansey Light-House to Oyster Cove.	1520	1-10,000	H. B. Mansfield, U. S. N.	1882.
Do	Delaware River, Bombay Hook to Collins Beach	1519	1-10,000	H. L. Marindin	1882.
Do	Delaware River, Collins Beach to Reedy Island Light.	1504 *b*	1-10,000	H. B. Mansfield, U. S. N.	1881.
Delaware	Delaware River, vicinity of Reedy Island	2160	1-2,400	H. L. Marindin	1893.
New Jersey and Delaware.	Delaware River, Liston Point to New Castle	133	1-10,000	G. S. Blake, U. S. N	1840-41.
Do	Delaware River, Stony Point to Delaware City, excluding channel.	1249 *b*	1-20,000	J. M. Grimes, U. S. N	1875.
Do	Delaware River, Reedy Island Light to Finns Point Light.	1504 *a*	1-10,000	H. L. Marindin	1881.
Do	Delaware River, Reedy Point to New Castle	808	1-10,000	G. Davidson	1861.
Do	Delaware River, Finns Point Light to New Castle	1503 *b*	1-10,000	H. L. Marindin	1881.
Do	Delaware River, Bulkhead Shoal	156	1-10,000	McArthur and Goldsborough, U. S. N.	1846-47.
Do	Delaware River, Pea Patch Island to New Castle Light.	134	1-20,000	G. S. Blake, U. S. N	1843.
Delaware	Delaware River, front of New Castle	1183 *a*	1-1,250	C. Junken	1873.
Do	.....do	1183 *b*	1-1,250	.....do	1873.
New Jersey and Delaware.	Delaware River, New Castle to Deep Water Point Light.	1503 *a*	1-5,000	H. L. Marindin	1881.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
New Jersey and Delaware.	Delaware River, New Castle to Cherry Island Range Lights.	135	1-10,000	G. S. Blake, U. S. N	1841.
Do	Delaware River, New Castle to Cherry Island Range Lights (copy of part of No. 135).	136	1-10,000	.....do	1841.
Delaware	Delaware River, Christiana and Brandywine creeks, mouth to bridges (enlarged from No. 135).	137	1-5,000	.....do	1841.
New Jersey, Delaware, and Pennsylvania.	Delaware River, Newcastle Flats to Marcus Hook Bar.	1394	1-10,000	C. Junken	1878.
Do	Delaware River, Deep Water Light to Penn Grove	1502 *b*	1-5,000	H. L. Marindin	1881.
Do	Delaware River, Penn Grove to Old Man Creek	1502 *a*	1-5,000	.....do	1881.
Do	Delaware River, Cherry Island Range Lights to Tonkins Island.	138	1-10,000	G. S. Blake, U. S. N	1842.
Do	Delaware River, Old Man Creek to Raccoon Creek	1501 *b*	1-5,000	H. L. Marindin	1881.
Do	Delaware River, Raccoon Creek to Chester Bar	1501 *a*	1-5,000	H. B. Mansfield, U. S. N	1881.
New Jersey and Pennsylvania.	Delaware River, Tonkins Island to Maiden Island	139	1-10,000	G. S. Blake, U. S. N	1842.
Pennsylvania	Delaware River, Welsh Street Wharf to Carson Wharf, Chester.	1057 *b*	1-1,200	C. Junken	1870.
Do	Delaware River, Ridley Creek to Welsh Street Wharf, Chester.	1057 *a*	1-1,200	.....do	1870.
New Jersey and Pennsylvania.	Delaware River, Chester Bar to east end Tinicum Island.	1490 *b*	1-5,000	H. B. Mansfield, U. S. N.	1881.
Do	Delaware River, Tinicum Island to Fort Mifflin	1490 *a*	1-5,000	H. L. Marindin	1881.
Do	Delaware River, Maiden Island to Fort Mifflin	140	1-5,000	G. S. Blake, U. S. N	1842.
Do	Delaware River, Fort Mifflin to Windmill Island	141	1-10,000	.....do	1842.
Do	Delaware River, Fort Mifflin to Gloucester Point	1114 *a*	1-5,000	F. F. Nes	1871.
Do	Delaware River, Fort Mifflin to Fish Club House (replotting of part of No. 141).	1422 *b*	1-4,800	G. S. Blake, U. S. N.	1843.
Do	Delaware River, Fort Mifflin to Horseshoe	1432 *b*	1-4,800	H. L. Marindin	1878.
Pennsylvania	Delaware River, Schuylkill River, Gloucester Point to Penrose Ferry Bridge.	1200 *c*	1-20,000	C. Junken	1875.
Do	Delaware River, Schuylkill River, League Island to Grays Ferry Bridge.	1943	1-4,800	J. Hergesheimer	1889.
Do	.....do	1200 *a*	1-5,000	F. F. Nes	1871.
Do	Delaware River, Schuylkill River, Rambo Point to Grays Ferry Bridge.	1630	1-1,200	C. Junken	1885.
Do	Delaware River, Schuylkill River, Grays Ferry Bridge to Suspension Bridge.	1200 *b*	1-5,000	F. F. Nes	1871.
Do	Delaware River, Schuylkill River, Grays Ferry Bridge to Fairmount Dam.	1944	1-4,800	J. Hergesheimer	1889.
Do	.....do	* 1852	1-4,800	.....do	1888-89.
Do	Delaware River, League Island Channel, back of League Island.	862	1-2,500	E. Hergesheimer	1865.
Do	Delaware River Docks, Gloucester Point to Cooper Point.	1939	1-9,600	J. Hergesheimer	1889.
New Jersey and Pennsylvania.	Delaware River, Horseshoe to Kaighns Point	1432 *a*	1-4,800	H. L. Marindin	1878.
Do	Delaware River, Fish Club House to Smith Island (replotting part of No. 141).	1422 *a*	1-4,800	G. S. Blake, U. S. N	1843.
Do	Delaware River, Gloucester Point to Windmill Island.	1114 *b*	1-5,000	F. F. Nes	1871.
Do	Delaware River, Kensington to Kaighns Point	1431 *b*	1-4,800	H. L. Marindin	1878.
Do	Delaware River, Kaighns Point to Eight Mile Point	142	* 1-10,000	G. S. Blake, U. S. N	1843.
Pennsylvania	Delaware River, Gravel and Shingle Bank, foot of Christian street, Philadelphia.	1657	1-300	H. L. Marindin	1878.
New Jersey and Pennsylvania.	Delaware River, Smith Island to Petty Island (replotting, part of No. 142).	1421 *b*	1-4,800	G. S. Blake, U. S. N	1843.
Do	Delaware River Docks, Cooper Point to east end Petty Island.	1940	1-9,600	J. Hergesheimer	1889.
Do	Delaware River, Kensington to Bridesburg	1431 *a*	1-4,800	H. L. Marindin	1878.
Do	Delaware River, Petty Island to Eight Mile Point (replotting, part of No. 142).	1421 *a*	1-4,800	G. S. Blake, U. S. N	1843.

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New Jersey and Pennsylvania.	Delaware River, submerged jetty to White Sheet Bay	2183	1-4,800	H. L. Marindin	1886.
Do	Delaware River, Eight Mile Point to Dunks	144	1-10,000	G. S. Blake, U. S. N.	1844.
Do	Delaware River, Dunks to Tullytown	145	1-10,000	....do	1844.
Do	Delaware River, Tullytown to south end Duck Island.	146	1-10,000	....do	1844.
Do	Delaware River, south end Duck Island to Trenton Bridge.	147	1-10,000	....do	1844.
Do	Delaware River (current sheet)	1982	1-4,800	H. L. Marindin	1878.
Do	....do	1983	1-4,800	....do	1878.
Do	....do	1984	1-4,800	....do	1878.
Do	....do	1985	1-4,800	....do	1877-78.
Do	....do	1986	1-4,800	....do	1878.
Do	....do	1987	1-4,800	....do	1878.
Do	....do	1988	1-4,800	....do	1878.
Delaware	Hen and Chickens Shoal	152	1-20,000	S. P. Lee, U. S. N.	1848.
Do	Cape Henlopen to Indian River Inlet	149	1-20,000	G. S. Blake, U. S. N	1844.
Do	Rehoboth to Indian River Inlet	1697	1-40,000	J. E. Pillsbury, U. S. N.	1886.
Do	Indian River Inlet and Bay and Rehoboth Bay	150	1-20,000	R. Bache, U. S. N	1847.
Delaware and Maryland.	Indian River Inlet to State line	212	1-40,000	S. P. Lee, U. S. N.	1848.
Maryland	Ocean City to Sinepuxent Bay	213	1-40,000	....do	1849.
Delaware and Maryland.	Inside waters, Miller Creek to Sinepuxent Bay	1816	1-20,000	D. B. Wainwright.	1887.
Maryland	North end Sinepuxent Bay to north end Assateague Bay.	251	1-40,000	S. P. Lee, U. S. N.	1848.
Do	Chincoteague Bay, upper part	1455 *b*	1-20,000	E. P. Lull, U. S. N., and D. B. Wainwright.	1880-87.
Maryland and Virginia.	Chincoteague Bay, lower part	1455 *a*	1-20,000	D. B. Wainwright	1887.
Maryland	Baltic Shoal	761	1-40,000	T. S. Phelps, U. S. N	1863.
Virginia	North end Assateague Bay to Chincoteague Inlet	297	1-20,000	J. J. Almy, U. S. N	1851.
Do	North end Assateague Bay to Gargathy Inlet	298	1-40,000	....do	1851.
Do	Chincoteague Shoal and Inlet	1487	1-20,000	Bradford and Wainwright	1881-87.
Do	Gargathy Inlet to Great Machipongo Inlet	348	1-40,000	J. J. Almy, U. S. N.	1852.
Do	Metompkin Inlet	349	1-10,000	....do	1852.
Do	Metompkin Inlet and Bay	795	1-20,000	A. M. Harrison	1862.
Do	Inside waters, Chincoteague Inlet to Floyd Bay	1803	1-20,000	D. B. Wainwright	1887-88.
Maryland	Wachapreague and Machipongo inlets	354	1-20,000	J. J. Almy, U. S. N.	1852.
Do	Little Machipongo Inlet to head of Broadwater	1104	1-20,000	J. W. Donn	1871.
Do	Broadwater, Great Machipongo River and branches.	1103	1-20,000	....do	1871.
Virginia	Hog Island to Cape Henry	397	1-40,000	J. J. Almy, U. S. N	1853.
Do	Sand Shoal and Ship Shoal inlets	388	1-20,000	....do	1853.
Do	Broadwater, Sand Shoal Inlet to Hog Island Inlet	1070 *b*	1-10,000	W. W. Harding	1870.
Do	Broadwater, Ship Shoal Inlet to Sand Shoal Inlet	1070 *a*	1-20,000	J. W. Donn	1870.
Do	Chesapeake Bay entrance, Little Inlet to Cape Henry.	1873	1-20,000	M. L. Wood, U. S. N.	1888.
Do	Chesapeake Bay entrance, Smith Inlet to Magothy Bay.	1875	1-10,000	....do	1888.
Do	Chesapeake Bay entrance, Magothy Bay	1013	1-20,000	W. W. Harding	1869.
Do	Chesapeake Bay entrance	286	1-20,000	B. F. Sands, U. S. N	1851.
Do	Chesapeake Bay entrance to Wolf Trap Light	364	1-40,000	J. J. Almy, U. S. N	1852.
Do	Chesapeake Bay entrance, Cape Charles and vicinity.	345	1-20,000	....do	1852.
Do	Chesapeake Bay entrance, Cape Charles to Old Plantation Creek.	1874	1-20,000	M. L. Wood, U. S. N.	1888.
Do	Chesapeake Bay, east shore, Cherrystone Inlet	353	1-20,000	J. J. Almy, U. S. N	1852.
Do	Chesapeake Bay, east shore, Cherrystone Inlet and Old Plantation Creek.	1169	1-10,000	J. S. Bradford	1873.
Do	Chesapeake Bay, east shore, Mattawoman Creek to Nandua Creek, and west shore, Wolf Trap Spit to Rappahannock Spit.	285	1-40,000	J. J. Almy, U. S. N	1851.
Do	Chesapeake Bay, east shore, Hunger Creek approaches and adjacent creeks.	368	1-20,000	....do	1853.
Do	Chesapeake Bay, east shore, Hunger Creek entrance.	976 *c*	1-20,000	C. Fendall	1868.
Do	Chesapeake Bay, east shore, Naswaddox Creek	976 *b*	1-20,000	....do	1868.

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Virginia	Chesapeake Bay, east shore, Occohannock Creek approaches and Heaths Landing.	367	1-20,000	J. J. Almy, U. S. N	1853.
Do	Chesapeake Bay, east shore, Craddock and Nandua creeks.	976 *a*	1-20,000	C. Fendall	1868.
Virginia and Maryland.	Chesapeake Bay, east shore, Nandua Creek to Smith Island, and west shore, Rappahannock Spit to Smith Point.	252	1-40,000	S. P. Lee, B. F. Sands, and J. J. Almy, U. S. N.	1849-50-51.
Virginia	Chesapeake Bay, east shore, Pengoteague Creek and approaches.	332	1-20,000	B. F. Sands and J. J. Almy, U. S. N., and C. Fendall.	1850-51. 1852-68.
Virginia and Maryland.	Chesapeake Bay, east shore, Pocomoke Sound	515	1-40,000	J. J. Almy, U. S. N.	1855.
Virginia	Chesapeake Bay, east shore, Pocomoke Sound, Onancock Creek to Mussongo Creek.	993	1-20,000	W. W. Harding	1869.
Virginia and Maryland.	Chesapeake Bay, east shore, Pocomoke River, entrance to Taylors.	1004	1-10,000	....do	1869.
Maryland	Chesapeake Bay, east shore, Pocomoke River, Taylors to Leaning Pine.	1022 *a*	1-5,000	....do	1869.
Do	Chesapeake Bay, east shore, Pocomoke River, Leaning Pine to Ilsleys House.	1022 *b*	1-5,000	....do	1869.
Do	Chesapeake Bay, east shore, Pocomoke River, Ilsleys House to Longs House.	1023 *a*	1-5,000	....do	1869.
Do	Chesapeake Bay, east shore, Pocomoke River, Longs House to Double.	1023 *b*	1-5,000	....do	1869.
Do	Chesapeake Bay, east shore, Pocomoke River, Double to Mattapony.	1024 *a*	1-5,000	....do	1869.
Do	Chesapeake Bay, east shore, Pocomoke River, Mattapony to Broad Creek.	1024 *b*	1-5,000	....do	1869.
Do	Chesapeake Bay, east shore, Pocomoke River, Broad Creek to Snow Hill.	1024 *c*	1-5,000	....do	1869.
Maryland and Virginia.	Chesapeake Bay, east shore, Tangier Sound, Watts Island Light to Clay Island Light.	557	1-40,000	J. J. Almy, U. S. N.	1856.
Do	Chesapeake Bay, east shore, south end Smith Island to Billy Island, and west shore, Smith Point to Point No Point.	211	1-20,000	S. P. Lee, U. S. N.	1849.
Virginia	Chesapeake Bay, east shore, Tangier Sound, vicinity of Smith, Goose, and Fox islands.	997	1-20,000	W. W. Harding	1869.
Maryland	Chesapeake Bay, east shore, Little Annemessex River, Crisfield Harbor.	985	1-10,000	....do	1868-69.
Do	Chesapeake Bay, east shore, Little Annemessex River, Big Annemessex River, Manokin River, Monie Bay, Wicomico River, and Ellis Bay.	707	1-20,000	W. T. Muse, U. S. N.	1858-59.
Do	Chesapeake Bay, east shore, Billy Island to Meekins Neck, and west shore, Point No Point to Cove Point Light.	209	1-20,000	S. P. Lee, U. S. N.	1848.
Do	Chesapeake Bay, east shore, Nanticoke River and Fishing Bay.	673	1-20,000	....do	1858.
Do	Chesapeake Bay, east shore, Meekins Neck to Tilghman Island and Cove Point Light to latitude 38° 40′.	199	1-20,000	W. P. McArthur, U. S. N.	1848.
Do	Chesapeake Bay, east shore, Little Choptank River or Hudson River.	200	1-20,000	....do	1848.
Do	Chesapeake Bay, east shore, Little Choptank River and tributaries.	1346 *b*	1-10,000	W. W. Harding	1871.
Do	Chesapeake Bay, east shore, Choptank River entrance.	201	1-20,000	W. P. McArthur, U. S. N.	1848.
Do	Chesapeake Bay, east shore, Choptank Light to Wing Landing, Fredhaven Creek and tributaries.	202	1-40,000	R. Bache, U. S. N.	1848.
Do	Chesapeake Bay, east shore, Choptank River and tributaries, Jenkins, Secretary, and Cabin creeks.	1346 *a*	1-10,000	W. W. Harding	1871.
Do	Chesapeake Bay, east shore Choptank River, Wing Landing to Denton.	1048	1-10,000	....do	1870.
Do	Chesapeake Bay, east shore, Fredhaven Creek and tributaries.	1049 *a*	1-10,000	....do	1870.
Do	Chesapeake Bay, east shore, Harris, Porters, and Broad creeks.	1049 *b*	1-10,000	....do	1870.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Maryland	Chesapeake Bay, east shore, Tilghman Island to latitude 38° 54'; west shore, latitude 38° 40' to South River.	188	1–20,000	S. P. Lee, U. S. N.	1846.
Do	Chesapeake Bay, east shore, Eastern Bay, Wye and Miles rivers.	177	1–20,000	W. P. McArthur, U. S. N., and W. W. Harding.	1847–70.
Do	Chesapeake Bay, east shore, St. Michael River and tributaries.	1050 *b*	1–10,000	W. W. Harding	1870.
Do	Chesapeake Bay, east shore, Wye River and tributaries.	1050 *a*	1–10,000	do	1870.
Do	Chesapeake Bay, east shore, latitude 38° 54' to latitude 39° 00'; west shore, Thomas Point to Sandy Point.	167	1–20,000	G. M. Bache, U. S. N.	1844.
Do	Chesapeake Bay, east shore, north end of Kent Island, Fairlee Creek; west shore, Sandy Point to Robbins Point.	166	1–20,000	do	1845.
Do	Chesapeake Bay, east shore, Chester River mouth	175	1–20,000	W. P. McArthur, U. S. N.	1847.
Do	Chesapeake Bay, east shore, Chester River, entrance to Chestertown.	174	1–20,000	do	1846.
Do	Chesapeake Bay, east shore, Chester River, Chestertown to Possum Point.	1026 *a*	1–5,000	W. W. Harding	1869–70.
Do	Chesapeake Bay, east shore, Possum Point to Crumpton.	1027	1–5,000	do	1869–70.
Do	Chesapeake Bay, east shore, Chester River, Morgan Creek Bridge to head of navigation.	1026 *b*	1–5,000	do	1870.
Do	Chesapeake Bay, east shore, Chester River, Langford Creek.	1078	1–10,000	do	1870.
Do	Chesapeake Bay, east shore, Fairlee Creek to Howell Point; west shore, Robbins Point to Old Womans Gut.	187	1–10,000	S. P. Lee, U. S. N.	1846.
Do	Chesapeake Bay, east shore, Fairlee, Churn, Still-pond, and Lloyd creeks.	1072	1–10,000	W. W. Harding	1870.
Do	Chesapeake Bay, east shore, Howell Point to Turkey Point; west shore, Old Womans Gut to Sandy Point.	186	1–10,000	S. P. Lee, U. S. N.	1846.
Do	Chesapeake Bay, east shore, Sassafras River, Grove Point to Wilsons Wharf.	176	1–20,000	W. P. McArthur, U. S. N.	1847.
Do	Chesapeake Bay, east shore, Sassafras River, Wilsons Wharf to head and tributary.	1071	1–10,000	W. W. Harding	1870.
Do	Chesapeake Bay, east shore, to Elk River, Turkey Point, Elk Landing.	172	1–10,000	W. P. McArthur, U. S. N.	1846.
Do	Chesapeake Bay, east shore, Bohemia River and Back Creek.	170	1–10,000	do	1846.
Do	Chesapeake Bay head, Turkey Point to Havre de Grace.	185	1–10,000	S. P. Lee, U. S. N.	1846.
Do	Chesapeake Bay head, Northeast River	173	1–10,000	W. P. McArthur, U. S. N.	1846.
Do	Chesapeake Bay head, Susquehanna River, Spesutic Island to Havre de Grace.	898	1–10,000	F. P. Webber	1872.
Do	Chesapeake Bay head, Susquehanna River, Havre de Grace Light to Silver Island.	168	1–10,000	W. P. McArthur, U. S. N.	1846.
Do	do	326	1–10,000	do	1846.
Do	Chesapeake Bay, west shore, Romney Creek	1072	1–10,000	W. W. Harding	1870.
Do	Chesapeake Bay, west shore, Bush River	171	1–20,000	W. P. McArthur, U. S. N.	1846.
Do	Chesapeake Bay, west shore, Gunpowder, Middle, and Back rivers.	169	1–20,000	do	1846.
Do	Chesapeake Bay, west shore, Patapsco River entrance.	415	1–20,000	R. Wainwright, U. S. N.	1854.
Do	Chesapeake Bay, west shore, Patapsco River mouth.	913	1–20,000	F. P. Webber	1866.
Do	Chesapeake Bay, west shore, Patapsco River, Belvidere Shoal and Swash Channel.	469	1–20,000	A. Boschke	1852.
Do	Chesapeake Bay, west shore, Patapsco River, Brewerton Channel, lower part.	915	1–10,000	F. P. Webber	1866.
Do	Chesapeake Bay, west shore, Patapsco River and Baltimore Harbor.	165	1–10,000	G. M. Bache, U. S. N.	1845.
Do	Chesapeake Bay, west shore, Patapsco River, Brewerton Channel.	914	1–10,000	F. P. Webber	1866.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Maryland	Chesapeake Bay, west shore, Patapsco River, tributary creeks.	1007	1-20,000	J. W. Donn	1869.
Do	Chesapeake Bay, west shore, Patapsco River, Sparrow Point and vicinity.	2067	1-10,000	.....do	1891.
Do	Chesapeake Bay, west shore, Patapsco River, Sparrow Point to Leading.	339	1-10,000	C. H. McBlair, U. S. N	1852.
Do	Chesapeake Bay, west shore, Patapsco River, Lazaretto Point to Hawkins Point.	1451	1-10,000	C. Junken	1880.
Do	Chesapeake Bay, west shore, Baltimore Harbor, Lazaretto Point to Ferry Point Bridge.	1450 *a*	1-3,600	J. W. Donn	1876.
Do	Chesapeake Bay, west shore, Baltimore Harbor, Ferry Point Bridge to head of Spring Garden.	1450 *b*	1-3,600	.....do	1877.
Do	Chesapeake Bay, west shore, Baltimore Harbor, Fort McHenry to Henderson Wharf.	1449 *a*, *b*	1-1,800	.....do	1876.
Do	Chesapeake Bay, west shore, Baltimore Harbor, Henderson Wharf to head of basin.	1448	1-1,800	.....do	1876.
Do	Chesapeake Bay, west shore, Magothy River	164	1-10,000	G. M. Bache, U. S. N	1845.
Do	Chesapeake Bay, west shore, Annapolis Harbor	1842	1-10,000	M. L. Wood, U. S. N	1888.
Do	Chesapeake Bay, west shore, Severn and South rivers, tributaries.	1077 *a*	1-10,000	W. W. Harding	1870.
Do	Chesapeake Bay, west shore, Severn River above Round Bay.	1077 *b*	1, 10,000	.....do	1870.
Do	Chesapeake Bay, west shore, Patuxent River mouth to Setterly Point.	210	1-20,000	S. P. Lee, U. S. N	1848.
Do	Chesapeake Bay, west shore, Patuxent River, Setterly Point to God Point.	641	1-20,000	W. T. Muse, U. S. N	1857.
Do	Chesapeake Bay, west shore, Patuxent River, Holland Point to Jones Point.	704	1-20,000	.....do	1859.
Maryland and Virginia.	Chesapeake Bay, Potomac River, Cornfield Point to Piney Point.	701	1-20,000	.....do	1859-60.
Maryland	Chesapeake Bay, Potomac River, St. Marys River, Cornfield Point to St. Marys City.	640	1-21,408	.....do	1857.
Do	Chesapeake Bay, Potomac River, St. Marys River, Kit Point to head of navigation.	695	1-20,000	.....do	1859.
Virginia	Chesapeake Bay, Potomac River, Yeocomico and Cone rivers.	968	1-20,000	J. W. Donn	1868.
Do	.....do	794	1-20,000	W. T. Muse, U. S. N	1860.
Maryland	Chesapeake Bay, Potomac River, Yeocomico and St. Georges rivers and St. Clement and Breton bays.	769	1-20,000	W. T. Muse, U. S. N., and J. W. Donn.	1860-68.
Maryland and Virginia.	Chesapeake Bay, Potomac River, Piney Point to Blakistone Island.	793	1-20,000	W. T. Muse, U. S. N	1860.
Virginia	Chesapeake Bay, Potomac River, Nomine Bay, Lower Machod and Mattox creeks.	967	1-20,000	J. W. Donn	1868.
Do	Chesapeake Bay, Potomac River, Blakistone Island to Cobb Point.	827	1-20,000	T. S. Phelps, U. S. N	1862.
Do	Chesapeake Bay, Potomac River, Cobb Point to Mathias.	778	1-20,000	.....do	1862.
Do	Chesapeake Bay, Potomac River, Lower Cedar Point and Mathias Point.	738	1-10,000	W. R. Palmer, U. S. A	1861.
Do	Chesapeake Bay, Potomac River, Mathias Point to Metompkin Point and Port Tobacco River.	813	1-20,000	E. S. Phelps, U. S. N	1862.
Do	Chesapeake Bay, Potomac River, Metompkin Point to Shipping Point.	812	1-20,000	.....do	1862.
Do	Chesapeake Bay, Potomac River, Shipping Point to Hallowing Point.	814	1-20,000	.....do	1862-63.
Do	Chesapeake Bay, Potomac River, Hallowing Point to Fort Washington.	815	1-20,000	.....do	1863.
Do	Chesapeake Bay, Potomac River, Fort Washington to Alexandria.	816	1-10,000	.....do	1863.
Maryland, Virginia, and District of Columbia.	Chesapeake Bay, Potomac River, Alexandria to Hunter Point.	766	1-10,000	C. P. Patterson	1862.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
District of Columbia.	Chesapeake Bay, Potomac River, end of Washington Channel.	2100	1–1,600	E. E. Haskell	1891.
Maryland, Virginia, and District of Columbia.	Chesapeake Bay, Potomac River, Hunter Point to Long Bridge.	764	1–5,000	C. P. Patterson	1862.
District of Columbia.	Chesapeake Bay, Potomac River, Anacostia River, Anacostia Bridge to Bennings Bridge.	863	1–5,000	A. Balbach	1865.
District of Columbia and Maryland.	Chesapeake Bay, Potomac River, Anacostia River, Bennings Bridge to Bladensburg.	864	1–5,000	.....do	1865.
District of Columbia and Virginia.	Chesapeake Bay, Potomac River, Long Bridge to Aqueduct Bridge.	765	1–5,000	C. P. Patterson	1862.
Do	Chesapeake Bay, Potomac River, Long Bridge to lower end of Analostan Island.	1082	1–5,000	C. Fendall	1867.
District of Columbia.	Chesapeake Bay, Potomac River, reported rock off Easby Point.	2004	1–5,000	H. L. Marindin	1890.
District of Columbia and Virginia.	Chesapeake Bay, Potomac River, Giesboro Point to the Sister Islands.	2042	880 feet to 1 inch.	M. C. Ewing	1837.
Do	Chesapeake Bay, Potomac River, Georgetown to foot of Little Falls.	*1340	1–2,500	C. Junken	1872.
Virginia	Chesapeake Bay, west shore, Great Wicomico River	1003	1–20,000	J. W. Donn	1869.
Do	Chesapeake Bay, west shore, creeks from Ingram Bay to Rappahannock River.	1005	1–20,000	.....do	1869.
Do	Chesapeake Bay, Rappahannock River, Stingray Point to Mosquito Point.	610	1–10,000	R. W. Wainwright, U. S. N.	1857.
Do	Chesapeake Bay, Mosquito Point to Grey Point	609	1–10,000	.....do	1857.
Do	Chesapeake Bay, Rappahannock River, Grey Point to Robinson Creek.	608	1–10,000	.....do	1857.
Do	Chesapeake Bay, Rappahannock River, Corratoman River and tributaries.	1001	1–10,000 1–20,000	J. W. Donn	1869.
Do	Chesapeake Bay, Rappahannock River, Le Grange Creek to Parrott Creek.	607	1–10,000	R. Wainwright, U. S. N.	1856.
Do	Chesapeake Bay, Rappahannock River, Corratoman River.	611	1–10,000	.....do	1857.
Do	Chesapeake Bay, Rappahannock River, Corratoman River tributaries.	1002	1–10,000	J. W. Donn	1869.
Do	Chesapeake Bay, Rappahannock River, Punch Bowl to Jones Point.	606	1–10,000	R. Wainwright, U. S. N.	1868.
Do	Chesapeake Bay, Rappahannock River, Jones Point to Accokeek Point.	605	1–10,000	.....do	1856.
Do	Chesapeake Bay, Rappahannock River, Bowls and Corner Rocks.	937	1–2,500	J. W. Donn	1867.
Do	Chesapeake Bay, Rappahannock River, Accokeek Point to Tappahannock.	523	1–10,000	R. Wainwright, U. S. N.	1855.
Do	Chesapeake Bay, Rappahannock River, Tappahannock to Occupacia Creek.	522	1–10,000	.....do	1855.
Do	Chesapeake Bay, Rappahannock River, Occupacia Creek, Leedstown.	521	1–10,000	.....do	1855.
Do	Chesapeake Bay, Rappahannock River, Leedstown to Northbend.	454	1–10,000	.....do	1854.
Do	Chesapeake Bay, Rappahannock River, Northbend, Gincatic Creek.	453	1–10,000	.....do	1854.
Do	Chesapeake Bay, Rappahannock River, Gincatic Creek, Millbank Creek.	452	1–5,000	.....do	1854.
Do	Chesapeake Bay, Rappahannock River, Millbank Creek to Skinner Creek.	451	1–5,000	.....do	1854.
Do	Chesapeake Bay, Rappahannock River, Skinner Neck to Moss Neck.	450	1–5,000	.....do	1854.
Do	Chesapeake Bay, Rappahannock River, Moss Neck to Hollywood.	400	1–5,000	.....do	1853–54.
Do	Chesapeake Bay, Rappahannock River, Hollywood to Belvidere.	399	1–5,000	.....do	1853–54.

* Topographic number.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Virginia	Chesapeake Bay, Rappahannock River, Belvidere to Fredericksburg.	398	1-5,000	R. Wainwright, U. S. N.	1853-54.
Do	Chesapeake Bay, west shore, Piankatank River	988	1-20,000	J. W. Donn	1869.
Do	Chesapeake Bay, west shore, Hill Bay and Milford Haven.	987	1-20,000	....do	1868-69.
Do	Chesapeake Bay, west shore, Mobjack Bay to Cape Henry.	446	1-40,000	J. J. Almy, U. S. N	1854.
Do	Chesapeake Bay, west shore, Mobjack estuaries	984	1-20,000	J. W. Donn	1868.
Do	Chesapeake Bay, west shore, York River, Clockston Creek to Baglers Mill.	583	1-20,000	J. J. Almy, U. S. N	1857.
Do	Chesapeake Bay, west shore, York River, Baglers Mill to West Point.	584	1-20,000	R. D. Miner, U. S. N	1857.
Do	Chesapeake Bay, Poquosin and Back rivers	977	1-20,000	C. Fendall and W. W. Harding.	1868.
Do	Chesapeake Bay, west shore, Horseshoe Shoal	1876	1-20,000	M. S. Wood, U. S. N	1888.
Do	Chesapeake Bay, Hampton Roads, Thimble Shoal Light to Newport News and Craney Island Light.	1188	1-20,000	R. Platt, U. S. N	1873.
Do	Chesapeake Bay, Hampton Roads to Newport News and Norfolk.	447	1-20,000	J. J. Almy, U. S. N	1854.
Do	Chesapeake Bay, James River entrance and Nansemond River to Suffolk.	1213	1-10,000	R. Platt, U. S. N	1874.
Do	Chesapeake Bay, James River, Newport News Point.	877	1-10,000	E. Hergesheimer	1865.
Do	Chesapeake Bay, James River, Craney Island to Mulberry Island.	529	1-20,000	J. N. Moffitt, U. S. N	1854-55.
Do	Chesapeake Bay, James River, Newport News to Point of Shoals Light.	1179 *a*	1-20,000	J. W. Donn	1871-72.
Do	Chesapeake Bay, James River, Point of Shoals Light to Cobham Bay.	1179 *b*	1-20,000	....do	1873.
Do	Chesapeake Bay, James River, Mulberry Island to Jamestown Island.	530	1-20,000	J. N. Moffitt, U. S. N	1855.
Do	Chesapeake Bay, James River, Jamestown Island to Dancing Point.	615	1-20,000	....do	1855.
Do	Chesapeake Bay, James River, Jamestown Island to Sandy Point.	1229	1-20,000	J. W. Donn	1874.
Do	Chesapeake Bay, James River, Chickahominy River mouth to Shipyard Landing.	1225 *a*	1-20,000	....do	1873-74.
Do	Chesapeake Bay, James River, Chickahominy River, Shipyard Landing to Forge Bridge.	1225 *b*	1-20,000	....do	1875.
Do	Chesapeake Bay, James River, Dancing Point to Dunmon.	616	1-10,000	J. N. Moffitt, U. S. N	1857.
Do	Chesapeake Bay, James River, Sandy Point to City Point.	1269	1-20,000	J. W. Donn	1875.
Do	Chesapeake Bay, James River, Little Brandon to Wyanoke Wharf.	634	1-10,000	J. N. Moffitt, U. S. N	1857.
Do	Chesapeake Bay, James River, Wyanoke Wharf, Coggins Point.	705	1-10,000	W. T. Muse, U. S. N	1859.
Do	Chesapeake Bay, James River, Harrison Bar	331	1-10,000	R. Wainwright, U. S. N	1852.
Do	Chesapeake Bay, James River, Coggins Point to Bermuda Hundred.	395	1-10,000	....do	1853.
Do	Chesapeake Bay, James River, Appomattox River, City Point upward.	2147	1-10,000	C. H. Boyd	1892.
Do	Chesapeake Bay, James River, Appomattox River, City Point to Broadway.	316	1-5,000	R. Wainwright, U. S. N	1852.
Do	Chesapeake Bay, James River, Appomattox River to Petersburg.	2126	1-10,000	C. H. Boyd	1892.
Do	Chesapeake Bay, James River, Appomattox River, Broadway to Hares Bar.	315	1-5,000	R. Wainwright, U. S. N	1852.
Do	Chesapeake Bay, James River, Appomattox River, Hares Bar to Petersburg.	314	1-5,000	....do	1852.
Do	Chesapeake Bay, James River, Appomattox River, near Petersburg.	279	1-10,000	....do	1851.
Do	Chesapeake Bay, James River, City Point to Curl Wharf.	1466 *a*	1-10,000	J. W. Donn	1880.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
Virginia	Chesapeake Bay, James River, Bermuda Hundred to Turkey Island.	394	1–5,000	R. Wainwright, U. S. N.	1853.
Do	Chesapeake Bay, James River, Turkey Island to Curl Wharf.	393	1–5,000	do	1853.
Do	Chesapeake Bay, James River, Curl Wharf to Drury Bluff.	1466 *b*	1–10,000	J. W. Donn	1880.
Do	Chesapeake Bay, James River, Curl Wharf to near Dutch Gap.	392	1–5,000	R. Wainwright, U. S. N.	1853.
Do	Chesapeake Bay, James River, vicinity of Dutch Gap.	391	1–5,000	do	1853.
Do	Chesapeake Bay, James River, Trent Reach Bar	340	1–5,000	do	1853.
Do	Chesapeake Bay, James River (same as No. 340)	343			
Do	Chesapeake Bay, James River, near Dutch Gap to Warwick Bar.	390	1–5,000	R. Wainwright, U. S. N.	1853.
Do	Chesapeake Bay, James River, Drury Bluff to Mayo Bridge.	1467	1–10,000	J. W. Donn and U. S. Engineers.	1879–80.
Do	Chesapeake Bay, James River, Warwick Bar to Albro Creek.	341	1–5,000	R. Wainwright, U. S. N.	1852–53.
Do	Chesapeake Bay, James River, Albro Creek to Mayo Bridge.	342	1–5,000	do	1852–53.
Do	Chesapeake Bay, Elizabeth River, Craney Island and vicinity.	1220	1–5,000	J. B. Baylor	1874.
Do	Chesapeake Bay, Elizabeth River, Tanner Creek to Fort Norfolk.	1515 *a*	1–10,000	E. B. Thomas, U. S. N	1882.
Do	Chesapeake Bay, Elizabeth River, Tanner Creek	1187 *a*	1–10,000	R. Platt, U. S. N.	1873.
Do	Chesapeake Bay, Elizabeth River, Craney Island to Norfolk.	1186 *b*	1–10,000	do	1872–73.
Do	Chesapeake Bay, Elizabeth River, West Branch	1187 *b*	1–10,000	do	1873.
Do	Chesapeake Bay, Elizabeth River, Fort Norfolk to navy-yard.	1515 *b*	1–10,000	C. M. Chester and E. Thomas, U. S. N.	1882.
Do	do	448	1–10,000	J. J. Almy, U. S. N	1854.
Do	Chesapeake Bay, Elizabeth River, Norfolk to navy-yard.	1186 *a*	1–5,000	R. Platt, U. S. N.	1872–73.
Do	Chesapeake Bay, Elizabeth River, Washington Point to navy-yard.	894	1–2,500	do	1866.
Do	Chesapeake Bay, Elizabeth River, navy-yard to base line.	1185 *b*	1–5,000	do	1872–73.
Do	Chesapeake Bay, Elizabeth River, navy-yard to Chesapeake and Albemarle Canal.	1579 *a*	1–20,000	G. C. Hanus, U. S. N.	1884.
Do	Chesapeake Bay, Elizabeth River, base line to Chesapeake and Albemarle Canal.	1185 *a*	1–10,000	R. Platt, U. S. N.	1873.
Do	Chesapeake Bay, Elizabeth River, Chesapeake and Albemarle Canal and head of North Landing River.	1579 *b*	1–20,000	G. C. Hanus, U. S. N.	1884.
Do	Chesapeake Bay, Lynn Haven Bay, and Tail of Horseshoe.	2064	1–20,000	L. K. Reynolds, U. S. N.	1891.
Do	Chesapeake Bay, Lynn Haven Inlet	449	1–10,000	J. J. Almy, U. S. N.	1854.
Do	Chesapeake Bay, Oyster Beds, vicinity Onancock Creek.	1963	1–20,000	G. Bradford	1881.
Do	Chesapeake Bay, Oyster Beds, vicinity Pungoteague Creek.	1964	1–4,000	do	1881.
Do	Chesapeake Bay, Oyster Beds, Tangier Sound	1441 *a*	1–40,000	F. Winslow, U. S. N.	1879.
Do	do	1441 *b*	1–40,000	do	1879.
Do	do	1447 *a*	1–40,000	do	1878.
Do	do	1447 *b*	1–40,000	do	1878.
Maryland	Chesapeake Bay and estuaries, densities of waters	1367 *a*	1–80,000	F. Collins, U. S. N.	1877.
Do	do	1367 *b*	1–80,000	do	1877.
Do	do	1367 *c*	1–80,000	do	1877.
Maryland and Virginia.	Boundary line between Maryland and Virginia (not a hydrographic sheet).	1319	1–80,000	W. J. Twining and U. S. Engineers.	1877.
	OUTSIDE WATERS FROM CAPE HENRY TO CAPE LOOKOUT.				
Virginia	Cape Henry to Sheep House Hill	520	1–40,000	J. J. Almy, U. S. N.	1855.
Do	Simmon Shoal, off False Cape	750	1–40,000	T. S. Phelps, U. S. N.	1861.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	OUTSIDE WATERS FROM CAPE HENRY TO CAPE LOOKOUT—continued.				
Virginia and North Carolina.	Sheephouse Hill to Kill Devil Hills	965	1-40,000	R. Platt, U. S. N.	1868.
North Carolina	Kill Devil Head to Loggerhead Inlet	1053	1-40,000	do	1870.
Do	From Loggerhead Inlet to Cape Hatteras	1056	1-40,000	do	1869-70.
Do	Cape Hatteras Shoals	244	1-20,000	T. A. Jenkins, U. S. N.	1850.
Do	do	1135	1-20,000	R. Platt, U. S. N.	1871-72.
Do	do	1136	1-40,000	do	1872.
Do	Cape Hatteras Shoals, Outer Diamond Shoals	2092	1-20,000	C. E. Vreeland, U. S. N.	1891.
Do	do	2184	1-20,000	L. M. Garrett, U. S. N.	1894.
Do	Offshore soundings near Cape Hatteras	2127	1-40,000	C. E. Vreeland, U. S. N.	1892.
Do	Cape Hatteras to Whale Bone Inlet	538	1-40,000	J. J. Almy, U. S. N.	1856.
Do	Ocracoke Inlet to Cape Lookout	1457	1-40,000	E. B. Thomas, U. S. N.	1880.
Do	Cape Lookout Shoals	885	1-40,000	R. Platt, U. S. N.	1865-66.
Do	do	849	1-40,000	T. S. Phelps, U. S. N.	1864.
	INSIDE WATERS FROM CHESAPEAKE AND ALBEMARLE CANAL AND BACK BAY TO CAPE LOOKOUT.				
Virginia and North Carolina.	Back Bay, Sheep Marsh Island to North Bay	1583	1-20,000	G. C. Hanus, U. S. N.	1884.
North Carolina	North Landing River, Black Water to Halfway Point.	703	1-20,000	J. Mechan	1859.
Virginia and North Carolina.	Currituck Sound, near head (reconnaissance)	702	1-10,000	do	1859.
Do	Currituck Sound, North Landing River to Lone Oak Channel.	1360	1-20,000	R. Wainwright, U. S. N.	1877.
North Carolina	Currituck Sound, Lone Oak Channel to Thoroughfare Channel.	258	1-20,000	do	1851.
Do	Currituck, Albemarle, Roanoke, and Croatan sounds.	257	1-20,000	do	1850-51.
Do	Albemarle Sound, Haulover to Wade Point	220	1-20,000	J. Alden	1849.
Do	Albemarle Sound, North River entrance to Beacon No. 10.	230	1-20,000	R. Wainwright, U. S. N.	1850.
Do	Albemarle Sound, Coanjock Cut from Coanjock Bay to North River.	1579 *c*	1-20,000	G. C. Hanus, U. S. N.	1884.
Do	Albemarle Sound, Pasquotank River entrance to bridge above Elizabeth City.	195	1-20,000	W. P. McArthur, U. S. N.	1847.
Do	Albemarle Sound, Wade Point to Scuppernong River.	198	1-20,000	do	1848.
Do	Albemarle Sound, Little River entrance to Creek Point.	197	1-20,000	do	1848.
Do	Albemarle Sound, Perquimans River entrance to Hertford.	196	1-20,000	do	1848.
Do	Albemarle Sound, Scuppernong River to Edenton Bay.	219	1-20,000	T. A. Jenkins, U. S. N.	1849.
Do	Albemarle Sound, Hornblower Point to Black Walnut Point.	216	1-20,000	do	1849.
Do	Albemarle Sound, Chowan River, Black Walnut Point to Coleran Wharf.	1230 *a*	1-20,000	R. E. Halter	1874.
Do	Albemarle Sound, Chowan River, Coleran Wharf, Herrell Landing.	1230 *b*	1-20,000	do	1874.
Do	Albemarle Sound, Batchelor Bay, Roanoke River entrance.	828	1-10,000	J. S. Bradford	1864.
Do	Albemarle Sound, Roanoke River delta	822	1-10,000	do	1864.
Do	Albemarle Sound, Bull Bay, Scuppernong River	217	1-20,000	T. A. Jenkins, U. S. N.	1849.
Do	Albemarle Sound, Alligator River entrance to Bear Point.	218	1-20,000	J. Olden, U. S. N.	1849.
Do	Albemarle Sound, Alligator River, Bear Point to Blunts Canal.	1315	1-20,000	R. Wainwright, U. S. N.	1876.
Do	Albemarle Sound, East, South, and Alligator lakes	1361	1-20,000	do	1877.
Do	Croatan Sound, Caroon Point to Benton Islands	1180 *b*	1-20,000	F. F. Nes	1873.
Do	Croatan Sound, Croatan Light to Roanoke Marshes Light.	1540	1-20,000	F. A. Wilner, U. S. N.	1883.
Do	Croatan Sound, channel from Croatan Light to Fulker Island.	836 *b*	1-20,000	J. S. Bradford	1864.

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	INSIDE WATERS FROM CHESAPEAKE AND ALBEMARLE CANAL AND BACK BAY TO CAPE LOOKOUT—continued.				
North Carolina....	Croatan Sound, Ashby Harbor to Roanoke Marshes Light.	836 *a*	1-20,000	J. S. Bradford............	1864.
Do............	Pamplico Sound, northern part, Roanoke Sound to Loggerhead Inlet.	1180 *a*	1-20,000	F. F. Nes..................	1873.
Do............	Pamplico Sound, Oregon Inlet........................	762	1-10,000	H. Mitchell................	1862.
Do............	Pamplico Sound, Oregon Inlet to Gibbs Shoal........	1363 *a*	1-40,000	R. Wainwright, U.S.N....	1875-76-77.
Do............	Pamplico Sound, Stumpy Bay to Long Shoal.........	1362 *b*	1-20,000	.....do....................	1876-77.
Do............	Pamplico Sound, outer end Long Shoal (reconnaissance).	887	1-10,000	J. S. Bradford.............	1866.
Do............	Pamplico Sound, Gull Island and vicinity...........	1363 *b*	1-40,000	R. Wainwright, U.S.N...	1877.
Do............	Pamplico Sound, vicinity of Cape Hatteras..........	672	1-40,000	W. T. Muse, U.S.N........	1858.
Do............	Pamplico Sound, Hatteras Inlet......................	1565	1-10,000	J. E. Pillsbury, U.S.N.....	1884.
Do............	.....do..	235	1-50,000	T. A. Jenkins, U.S.N.....	1850.
Do............	.....do..	322	1-10,000	R. Wainwright, U.S.N....	1852.
Do............	.....do..	612	1-10,000	W. T. Muse, U.S.N........	1857.
Do............	Pamplico Sound, Hatteras Inlet, inner bulkhead (reconnaissance).	612 *bis*	1-10,000	G. A. Fairfield and A. Strausz.	1864.
Do............	Pamplico Sound, Hatteras Inlet......................	763	1-10,000	T. S. Phelps, U.S.N.......	1861.
Do............	Pamplico Sound, Long Shore Point to Middleton Anchorage.	1362 *a*	1-20,000	R. Wainwright, U.S.N....	1875-76.
Do............	Pamplico Sound, Gibbs Point to Bluff Shoal..........	1254	1-20,000	H. O. Handy, U.S.N......	1875.
Do............	Pamplico Sound, vicinity of Ocracoke Inlet..........	661	1-20,000	W. T. Muse, U.S.N........	1857-58.
Do............	Pamplico Sound, Ocracoke Inlet.....................	1364	1-20,000	R. Wainwright, U.S.N....	1877.
Do............	.....do..	321	1-10,000	.....do....................	1852.
Do............	.....do..	613	1-20,000	W. T. Muse, U.S.N........	1857.
Do............	Pamplico Sound, Hog Island to Juniper Point........	1226 *b*	1-20,000	F. F. Nes..................	1874.
Do............	Pamplico Sound, Middle Ground, Bluff Shoal to Brant Shoal.	1227	1-40,000	.....do....................	1874.
Do............	Pamplico Sound, Juniper Bay Point to Rose Bay.....	1226 *a*	1-20,000	.....do....................	1874.
Do............	Pamplico Sound, Brant Island to Neuse River Light..	1010	1-20,000	.....do....................	1869.
Do............	Pamplico Sound, Pamplico River, entrance to Indian.	1088	1-20,000	.....do....................	1870.
Do............	Pamplico Sound, Pungo River, Wade Point, Duran Point.	1140 *a*	1-20,000	.....do....................	1872.
Do............	Pamplico Sound, Pungo River, Duran Point to head of river.	1140 *b*	1-20,000	.....do....................	1872-74.
Do............	Pamplico Sound, Pamplico River, Adams Point to Rumley Marsh.	1099	1-20,000	.....do....................	1871.
Do............	Pamplico Sound, Pamplico River, Rumley Marsh, Maul Point.	1100	1-20,000	.....do....................	1871.
Do............	Pamplico Sound, Pamplico River, Maul Point to Rodman Point.	1101	1-20,000	.....do....................	1871.
Do............	Pamplico Sound, Pamplico River, Cedar Grove to Tar River.	1132	1-10,000	.....do....................	1872.
Do............	Pamplico Sound, Bay River, Ball Island to Mill Pond.	1011	1-20,000	.....do....................	1869.
Do............	Pamplico Sound, Neuse River Light to Gasbacon Shoal.	974	1-20,000	J. S. Bradford............	1868.
Do............	Pamplico Sound, Neuse River, South River, Turnagain and Rattan Bay.	975	1-20,000	J. S. Bradford and F. F. Ness.	1868-69.
Do............	Pamplico Sound, Neuse River, Cedar Point to Cherry Point.	963	1-20,000	J. S. Bradford............	1868.
Do............	Pamplico Sound, Neuse River, Cherry Point to Johnson Point.	956	1-20,000	.....do....................	1867-68.
Do............	Pamplico Sound, Neuse River, Johnson Point to Fort Anderson.	892	1-10,000	.....do....................	1866.
Do............	Pamplico Sound, Neuse River, Quarantine Station to Fort Anderson.	845	1-20,000	A. Strausz.................	1863-64.
Do............	Pamplico Sound, Royal Shoal Light to Brant Shoal and Core Sound.	1083	1-40,000	J. S. Bradford............	1866-69-70.
Do............	Pamplico Sound, Core Sound and Cedar Island Bay..	1079	1-20,000	F. F. Nes..................	1870.
Do............	Core Sound, Harbor Bar Light to White Point........	1347	1-20,000	J. F. Moser, U.S.N.......	1877.

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	INSIDE WATERS FROM CHESAPEAKE AND ALBEMARLE CANAL AND BACK BAY TO CAPE LOOKOUT—continued.				
North Carolina....	Core Sound, Pamplico Sound to Davis Island.........	855	1-40,000	E. Cordell.................	1864.
Do............	Core Sound, White Point to Bell Point...............	1316 *b*	1-20,000	J. M. Grimes..............	1876.
Do............	Core Sound, Davis Island to Beaufort................	854	1-20,000	E. Cordell.................	1864.
Do............	Core Sound, Bell Point to Middle Marshes...........	1316 *a*	1-20,000	J. M. Grimes, U. S. N.......	1876.
	CAPE LOOKOUT TO CAPE FEAR.				
North Carolina....	Cape Lookout to Rock Point, Bogue Sound...........	577	1-40,000	C. R. P. Rodgers, U. S. N ...	1857.
Do	Cape Lookout to Beaufort	419	1-10,000	J. N. Maffitt, U. S. N.......	1854.
Do............	Lookout Bight	1391	1-5,000	F. Collins, U. S. N..........	1878.
Do............	Beaufort Bar...	576	1-10,000	C. R. P. Rodgers, U. S. N ...	1857.
Do............	Beaufort Harbor	259	1-10,000	J. N. Maffitt, U. S. N.......	1850.
Do............	.....do	856	1-10,000	E. Cordell	1864.
Do............	Beaufort Harbor entrance............................	246	1-10,000	J. N. Maffitt, U. S. N	1850.
Do............	Beaufort Harbor	789	1-10,000	A. Boschke	1862.
Do............	Beaufort Harbor, vicinity Fort Macon (special survey)	789 *bis*	1-2,400	A. Strausz	1863.
Do............	Beaufort Harbor and adjacent waters.................	1219	1-20,000	W. I. Vinal.................	1874.
Do............	Beaufort Harbor and Bogue Sound to Carolina City..	418	1-10,000	J. N. Maffitt, U. S. N........	1854.
Do............	Newport River and estuaries.........................	1203	1-20,000	W. I. Vinal.................	1874.
Do............	Bogue Sound, Carolina City to Hunting Island.......	1348	1-20,000	J. F. Moser, U. S. N	1877.
Do............	Rocky Point (Bogue Sound) to New River Inlet......	644	1-40,000	A. Murray, U. S. N..........	1858-59.
Do............	Bogue Inlet..	2066	1-10,000	W. C. Hodgkins	1888.
Do............	Bear and Brown Inlet	2065	1-10,000	.....do	1888.
Do............	New River Inlet to Queen Inlet....	1456	1-40,000	E. B. Thomas, U. S. N......	1880.
Do........ ...	New River Inlet and Bar	280	1-10,000	J. N. Maffitt, U. S. N........	1851.
Do............	New River Inlet (reconnaissance)	1841	1-10,000	W. C. Hodgkins	1888.
Do............	Topsail Sound, Sloop Point to Topsail Inlet and Old Topsail Inlet.	*711	1-20,000	J. Mecham	1857-58.
Do	Queen Inlet to Federal Point, Wrightsville and Masonboro inlets.	1423	1-40,000 1-10,000	J. F. Moser and R. Wainwright, U. S. N.	1879-87.
Do............	Frying Pan Shoals.....................................	277	1-20,000	T. A. Jenkins, U. S. N......	1851.
Do............	Frying Pan Shoals (duplicate of No. 277)............	306	....	....	
Do............	Frying Pan Shoal.....................................	1517	1-40,000	W. H. Brownson, U. S. N..	1882.
Do............	Cape Fear to Tubbs Inlet............................	685	1-40,000	J. P. Bankhead, U. S. N....	1859.
Do............	Cape Fear River entrance, New Inlet.................	1769	1-10,000	J. E. Pillsbury, U. S. N.....	1887.
Do............	.....do	278	1-10,000	J. N. Maffitt, U. S. N.......	1851.
Do............	Cape Fear River entrance, New Inlet Bar............	370	1-10,000	.....do	1852.
Do............	.....do	618	1-10,000	.....do	1856.
Do............	.....do	621	1-10,000	.....do	1857.
Do............	Cape Fear River entrance, New Inlet.................	643	1-10,000	T. B. Huger, U. S. N........	1858.
Do............	.....do	875	1-10,000	J. S. Bradford.............	1865.
Do............	.....do	1134	1-10,000	W. I. Vinal.................	1872.
Do............	Cape Fear River entrance............................	372	1-10,000	J. N. Maffitt, U. S. N.......	1852.
Do............	.....do	619	1-10,000	.....do	1856.
Do............	Cape Fear River entrance, Bar.......................	642	1-10,000	T. B. Huger, U. S. N	1858.
Do............	.....do	624	1-10,000	J. N. Maffitt, U. S. N.......	1857.
Do............	Cape Fear River entrance............................	870	1-10,000	J. S. Bradford.............	1865.
Do............	Cape Fear River entrance, Inner Bar..................	1014	1-5,000	F. F. Nes..................	1870.
Do............	Cape Fear River entrance............................	1089	1-5,000	R. Platt, U. S. N............	1869.
Do............	.... do	1128 *a*	1-10,000	W. I. Vinal.................	1872.
Do............	.....do	1128 *b*	1-10,000	.....do	1874.
Do............	Cape Fear River entrance, Swash Channel...........	1190 *a*	1-10,000	.....do	1873.
Do............	Cape Fear River entrance............................	1547	1-10,000	F. A. Wilner, U. S. N......	1883.
Do............	Cape Fear River, channel from Fort Caswell to Battery Island.	876	1-10,000	J. S. Bradford	1866.
Do............	Cape Fear River, Zekes Island to Campbell Island...	374	1-10,000	J. N. Maffitt, U. S. N.......	1853.
Do............	Cape Fear River, plan of final attack on Fort Fisher.	* 1995	1-5,000	.....do	1865.
Do............	Cape Fear River, Peters Point to Ballast Rock........	1190 *b*	1-10,000	W. I. Vinal	1873.
Do............	Cape Fear River, Ballast Rock to Redmon Creek....	1191 *a*	1-10,000	.....do	1873.
Do............	Cape Fear River, Campbell Island to Brunswick River entrance.	416	1-10,000	J. N. Maffitt, U. S. N.......	1853.

* Topographic number.

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	CAPE LOOKOUT TO CAPE FEAR—continued.				
North Carolina....	Cape Fear River, Brunswick River entrance to railroad bridge.	375	1-5,000	J. N. Maffitt, U. S. N.......	1853.
Do............	Cape Fear River, Redmon Creek to Wilmington......	1191 *b*	1-10,000	W. I. Vinal...............	1873.
	OYSTER INVESTIGATION SHEETS, CAROLINA SOUNDS.				
North Carolina....	Pamplico Sound..........................	1856	1-10,000	F. Winslow, U. S. N........	1886.
Do............	Pamplico Sound, northern part..............	1862	1-10,000	.....do..................	1886.
Do............	.....do..................................	1863	1-10,000	.....do..................	1886.
Do............	.....do..................................	1864	1-10,000	.....do..................	1886.
Do............	Pamplico Sound, eastern part...............	1865	1-10,000	.....do..................	1886.
Do............	Pamplico Sound, Hatteras Inlet and vicinity.........	1866	1-20,000	.....do..................	1877-78.
Do............	Pamplico Sound, Long Shoal Point to Middletown...	1867	1-20,000	.....do..................	1887.
Do............	Pamplico Sound, Middletown to Juniper Bay Point..	1868	1-20,000	.....do..................	1887.
Do............	Pamplico Sound, Juniper Bay Point to Bell Bay......	1869	1-20,000	.....do..................	1887.
Do............	Pamplico Sound, Hatteras Inlet to Fishammock △...	1870	1-20,000	.....do..................	1887-88.
Do............	Pamplico Sound, Ocracoke Inlet and vicinity.........	1871	1-20,000	.....do..................	1887-88.
Do............	Pamplico Sound, Pamplico Light to Neuse River Light.	1872	1-20,000	.....do..................	1888.
Do............	Cedar Island Bay..........................	1857	1-10,000	.....do..................	1886.
Do............	.....do..................................	1858	1-10,000	.....do..................	1886.
Do............	.....do..................................	1859	1-10,000	.....do..................	1886.
Do............	Thoroughfare Bay..........................	1854	1-10,000	.....do..................	1886.
Do............	Core Sound...............................	1851	1-10,000	.....do..................	1886.
Do............	.....do..................................	1853	1-10,000	.....do..................	1886.
Do............	.....do..................................	1855	1-10,000	.....do..................	1886.
Do............	Nelson Bay...............................	1852	1-10,000	.....do..................	1886.
Do............	Back Sound..............................	1849	1-10,000	.....do..................	1886.
Do............	The Straits...............................	1850	1-10,000	.....do..................	1886.
Do............	North River..............................	1848	1-10,000	.....do..................	1886.
Do............	Newport River, lower part...................	1847	1-10,000	.....do..................	1886.
Do............	Newport River, upper part...................	1846	1-10,000	.....do..................	1886.
Do............	White Oak River...........................	1860	1-10,000	.....do..................	1886.
Do............	New River...............................	1861	1-10,000	.....do..................	1886.
	CAPE FEAR TO MOSQUITO INLET.				
North Carolina and South Carolina.	Tubb Inlet to Eight Mile Swash..................	1393 *a*	1-40,000	J. F. Moser, U. S. N........	1878.
Do............	Little River Inlet and River to Calabash Creek.......	1393 *b*	1-20,000	.....do..................	1878.
South Carolina....	Eight Mile Swash to Winyah entrance..............	1419	1-40,000	.....do..................	1878-79.
Do............	Georgetown Light to Cape Romain................	350	1-20,000	T. A. Craven, U. S. N.......	1852.
Do............	Georgetown Bar...........................	533	1-20,000	J. N. Maffitt, U. S. N.......	1856.
Do............	Georgetown Bar and Harbor..................	371	1-10,000	.....do..................	1853.
Do............	Winyah Bay entrance.......................	1318	1-20,000	C. F. Hutchins, U. S. N.....	1876.
Do............	Winyah Bay and Georgetown Harbor............	373	1-10,000	J. N. Maffitt, U. S. N.......	1853.
Do............	Sampit River.............................	1412	1-5,000	J. F. Moser, U. S. N........	1879.
Do............	Santee River entrance......................	1675	1-10,000	G. C. Hanus, U. S. N.......	1886.
Do............	Santee River entrance up 3 miles...............	1194	1-10,000	W. H. Dennis.............	1873.
Do............	Santee River, Little Crow and Cedar islands, up about 4 miles.	1193 *b*	1-10,000	.....do..................	1873.
Do............	Santee River, upper part to Causeway Canal.........	1193 *a*	1-10,000	.....do..................	1873.
Do............	Cape Romain and vicinity....................	1551	1-10,000	J. T. Sullivan, U. S. N......	1883.
Do............	Romain River, creeks and bays in vicinity of Cape Romain.	1238 *b*	1-10,000	W. H. Dennis.............	1874.
Do............	.....do..................................	1238 *a*	1-10,000	.....do..................	1874.
Do............	Cape Romain to Charleston entrance.............	626	1-40,000	J. N. Maffitt, U. S. N.......	1857.
Do............	Bull Bay................................	683	1-20,000	J. P. Bankhead, U. S. N....	1859.
Do............	.....do..................................	1674	1-20,000	G. C. Hanus, U. S. N.......	1886.
Do............	Bull Bay, inland waters.....................	1276 *a*	1-10,000	W. H. Dennis.............	1875.
Do............	.....do..................................	1276 *b*	1-10,000	.....do..................	1875.
Do............	Bull Bay and Caper Inlet, inland waters............	1277 *a*	1-10,000	.....do..................	1875.

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	CAPE FEAR TO MOSQUITO INLET—continued.				
South Carolina....	Pricer, Caper, and Dewee inlets....................	1680	1-10,000	G. C. Hanus, U. S. N	1886.
Do............	Caper Inlet to Beach Inlet, inland waters............	1277 *b*	1-10,000	W. H. Dennis.............	1875.
Do............	Charleston to Savannah River (compiled)...........	649	1-40,000	J. N. Maffitt, U. S. N	1853-57.
Do............	Charleston Bar..................................	874	1-20,000	C. O. Boutelle.............	1865.
Do............	Charleston entrance and harbor	254	1-10,000	J. N. Maffitt, U. S. N	1851.
Do............	Charleston entrance, Pumpkin Hill Channel.........	625	1-10,000	.....do..................	1857.
Do............	Charleston entrance and bar to harbor	536	1-5,000	.....do..................	1852.
Do............	Charleston Bar..................................	852	1-20,000	W. S. Edwards and F. P. Webber.	1863-64.
Do............	.....do.......................................	2221	1-20,000	L. M. Garrett, U. S. N......	1895.
Do............	Charleston Bar, main channel.....................	981	1-20,000	R. E. Halter	1869.
Do............	Charleston Bar..................................	1656	1-20,000	G. C. Hanus, U. S. N	1886.
Do............	Charleston entrance, Beach Channel...............	411	1-10,000	J. N. Maffitt, U. S. N	1854.
Do............	.....do.......................................	476	1-5,000	.....do..................	1855.
Do............	.....do.......................................	532	1-5,000	.....do..................	1856.
Do............	.....do.......................................	623	1-5,000	.....do..................	1857.
Do............	.....do.......................................	718	1-10,000	J. P. Bankhead, U. S. N	1860.
Do............	Charleston Harbor...............................	2222	1-10,000	L. M. Garrett, U. S. N......	1895.
Do............	.....do.......................................	881	1-10,000	C. O. Boutelle.............	1865.
Do............	Wando River mouth to half a mile above Ralston Creek.	2190	1-10,000	R. G. Peck, U. S. N........	1894.
Do............	Cooper River, Shipyard Creek to Woods Point	2189	1-10,000	.....do..................	1894.
Do............	Ashley River, near bridge to narrows above Bull Creek.	2187	1-10,000	.....do..................	1894.
Do............	Ashley River, narrows above Bull Creek to Lambs ...	2188	1-10,000	.....do..................	1895.
Do............	Light-House Inlet and inland passage to Folly River.	853	1-10,000	F. P. Webber	1864.
Do............	Stone Inlet, Kiawah and Folly rivers	803	1-20,000	C. O. Boutelle.............	1862.
Do............	North Edisto Harbor, Bar, and River	272	1-20,000	J. N. Maffitt, U. S. N	1851.
Do............	North Edisto River approaches....................	534	1-20,000	.....do..................	1855-56.
Do............	Wadmalaw and Stono rivers.......................	1639	1-20,000	G. C. Hanus, U. S. N.......	1885.
Do............	St. Helena Sound and Bar, South Edisto River and Bar.	620	1-15,000	J. N. Maffitt, U. S. N........	1856-57.
Do	St. Helena Sound, vicinity Hunting Island...........	1349 *b*	1-20,000	J. F. Moser, U. S. N........	1876.
Do............	South Edisto River and adjacent waters.............	1349 *a*	1-20,000	.....do..................	1875-76.
Do............	Combahee and Ashepoo rivers and estuaries.........	1206	1-10,000	C. Hosmer................	1873.
Do............	Coosaw River, St. Helena Sound to Brickyard Creek..	742	1-10,000	J. P. Bankhead, U. S. N....	1860.
Do............	Parrot Creek, Morgan River to Coosaw River, and part of Morgan River.	744	1-10,000	.....do..................	1860.
Do............	Bull and Combahee rivers and North Winbee Creek..	1084	1-10,000 } 1-2,000 }	C. Hosmer and J. N. McClintock.	1871.
Do............	Coosaw River....................................	1155 *b*	1-10,000	C. Hosmer................	1873.
Do............	Inland passage, Coosaw River to Beaufort River......	1155 *a*	1-20,000	.....do..................	1872.
Do............	Inland passage, Port Royal Bay and St. Helena Sound, Fripp Inlet Harbor and Stono River.	833	....	....	
South Carolina and Georgia.	Port Royal Sound to Wassaw Sound................	966	1-40,000	C. O. Boutelle.............	1866.
South Carolina....	Port Royal Sound, entrance and bay................	535	1-20,000	J. N. Maffitt, U. S. N.......	1855-56.
Do............	Port Royal Sound, entrance.......................	830	1-20,000	C. O. Boutelle.............	1863.
Do............	.....do.......................................	677	1-20,000	C. M. Fauntleroy, U. S. N..	1859.
Do............	Inland passage between Port Royal Sound and St. Helena Sound, Trenchard Inlet and Stono Creek.	832	1-10,000	W. S. Edwards............	1863.
Do............	Port Royal Sound and Broad River to Eutaw Creek..	831	1-20,000	C. O. Boutelle.............	1862-63.
Do............	Port Royal Sound and Beaufort River, Bay Point to Battery Creek.	2119	1-10,000	C. E. Vreeland, U. S. N.....	1892.
Do............	Beaufort River, entrance to Beaufort................	633	1-10,000	J. N. Maffitt, U. S. N	1855.
Do............	Beaufort River, mouth to Little Marsh Island, on Perry Island shore.	802	1-10,000	W. S. Edwards............	1862.
Do............	Beaufort River, Paris Spit to Battery Creek..........	1521	1-10,000	W. H. Brownson, U. S. N..	1882.
Do............	Beaufort River, opposite Upper Beacon Light to Beaufort, Arches, Battery, and part of Chowan Creek.	834	1-10,000	W. S. Edwards............	1862.
Do............	Chowan, Jericho, and Ballast creeks.................	962	1-10,000	C. Hosmer................	1868.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	CAPE FEAR TO MOSQUITO INLET—continued.				
South Carolina....	Beaufort River, Battery Creek to Old Fort, and including lower part of Battery Creek.	2120	1-10,000	C. E. Vreeland, U. S. N....	1892.
Do............	Brickyard Creek, Coosaw River to Beaufort..........	743	1-10,000	J. P. Bankhead, U. S. N....	1860.
Do............	Broad River, Eutaw Creek to Whale Island..........	869	1-10,000	R. E. Halter..............	1865.
Do............	Broad and Coosaw rivers..........................	868	1-10,000	.....do....................	1865.
Do............	Checkessee River and Colleton River.................	679	1-10,000	T. M. Fauntleroy, U. S. N..	1859.
Do............	Eutaw Creek, Checkeesee and Colleton rivers, Mackay Creek, and May River.	*1195	1-20,000	C. Hosmer................	1870-71.
Do............	Skull Creek, Claibogue Sound to Port Royal Sound...	805	1-10,000	C. O. Boutelle.............	1861-62.
South Carolina and Georgia.	Savannah River entrance and bar....................	439	1-20,000	J. N. Maffitt, U. S. N.......	1854.
Do............	Savannah River entrance	944	1-20,000	C. O. Boutelle.............	1866.
Do............	Savannah River entrance, Tybee Roads and Bar.....	269	1-20,000	J. N. Maffitt, U. S. N.......	1851.
Do............	Savannah River, entrance to upper end of Elba Island.	317	1-10,000	.....do....................	1852.
Do............	Savannah River entrance, Tybee Roads and Lazaretto Creek.	842	1-10,000	W. S. Edwards...........	1863.
Do............	Savannah River entrance, Claibogue Sound and part of Broad Creek.	804	1-10,000	.....do....................	1862.
Do............	Savannah River entrance, Cooper, New, Back, and Wright rivers.	*1196	1-20,000	C. Hosmer................	1870-71.
Do............	Savannah River entrance, Tybee Island Light to Oyster Beds Light.	2194	1-10,000	L. M. Garrett, U. S. N......	1894.
Do............	Savannah River entrance, Tybee Roads and Bar and channel to Savannah.	1264	1-5,000	J. M. Hawley, U. S. N., and U. S. Engineers.	1875-89.
Georgia	Savannah River entrance (dynamic chart)...........	1970	1-10,000	H. L. Marindin...........	1874.
South Carolina and Georgia.	Savannah River, Tybee Light to Elba Island.........	945	1-10,000	C. O. Boutelle.............	1866.
Do............	Savannah River, Tybee Island to upper end of Elba Island.	267	1-10,000	J. N. Maffitt, U. S. N.......	1850.
Do............	Savannah River, opposite Fort Pulaski	807	1-10,000	C. O. Boutelle.............	1862.
Do............	Savannah River, Oyster Beds Light to Jones Island Beacon.	2195	1-10,000	L. M. Garrett, U. S. N......	1894.
Do............	Savannah River, Turtle Island to Duck Island........	1263 *b*	1-5,000	J. M. Hawley, U. S. N......	1875.
Do............	Savannah River, entrance east end Elba Island to Fig Island.	946	1-10,000	C. O. Boutelle.............	1865-66.
Do............	Savannah River, Jones Island Beacon to Savannah...	2196	1-10,000	L. M. Garrett.............	1894.
Do............	Savannah River, Elba Island and vicinity............	1263 *a*	1-5,000	J. M. Hawley, U. S. N......	1875.
Do............	Savannah River, Elba Island to middle of Hutchins Island.	318	1-5,000	J. N. Maffitt, U. S. N.......	1851.
Do.	Savannah River, Elba Island to Onslow Island, Foure and Back rivers.	266	1-10,000	.....do....................	1851.
Do............	Savannah River, Fort Jackson and vicinity...........	1223 *b*	1-2,400	C. Hosmer................	1874.
Georgia	Savannah River, city front...........................	947	1-5,000	C. O. Boutelle............	1865-66.
Do............	Savannah River, Savannah and vicinity..............	1223 *a*	1-2,400	C. Hosmer................	1874.
Do............	.....do...	1222 *b*	1-2,400	.....do....................	1874.
South Carolina and Georgia.	Savannah River, middle of Hutchins Island to Onslow Island.	319	1-5,000	J. N. Maffitt, U. S. N.......	1852.
Georgia	Savannah River, Cross Tides and vicinity............	1222 *a*	1-2,400	C. Hosmer................	1874.
South Carolina and Georgia.	Savannah River, Hutchins Island to upper end of Isla Island.	320	1-5,000	J. N. Maffitt, U. S. N.......	1852.
Georgia	Wassaw Sound entrance..............................	904 *a*	1-20,000	C. O. Boutelle............	1864-66.
Do............	Wassaw Sound, confluence to Tybee and Wilmington rivers.	904 *b*	1-20,000	W. S. Edwards...........	1863.
Do............	Wilmington River and creeks in Romney Marshes...	617	1-5,000	J. N. Maffitt, U. S. N.......	1856.
Do............	Wilmington River and estuaries......................	866	1-20,000	C. Fendall................	1866.
Do............	Ossabaw Sound, Ogeechee and Vernon rivers.........	733	1-20,000	T. S. Phelps, U. S. N.......	1860.
Do............	Ogeechee, Vernon, and Burnside rivers..............	867	1-20,000	C. Fendall................	1865.
Do............	St. Catherines Sound entrance........................	928	1-20,000	C. Junken................	1867.
Do............	St. Catherines Sound and estuaries..................	916	1-20,000	.....do....................	1867.
Do............	Sapelo approaches and bar...........................	691	1-20,000	C. M. Fauntleroy, U. S. N...	1859.
Do............	Sapelo Sound..	659	1-10,000	J. H. Moore, U. S. N.......	1858.

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	CAPE FEAR TO MOSQUITO INLET—continued.				
Georgia	Sapelo Sound and adjacent waters	660	1-10,000	J. H. Moore, U. S. N.	1858.
Do.	Doboy approaches	957	1-20,000	C. Junken	1868.
Do.	Doboy Sound and bar (reconnaissance)	461	1-20,000	T. A. Craven, U. S. N	1854.
Do.	Doboy Sound, part of Darien and North rivers and adjacent creeks.	964	1-10,000	C. Junken	1868.
Do.	Inland passages between Sapelo and Doboy Sound	959	1-10,000	do	1868.
Do.	Altamaha Sound to St. Simon Sound	810	1-20,000	J. P. Bankhead, U. S. N.	1860.
Do.	Inland passage between Doboy and St. Simon sounds.	1146	1-20,000	F. P. Webber	1872.
Do.	St. Simon Sound entrance, bar, and harbor	537	1-10,000	S. D. Trenchard, U. S. N.	1856.
Do.	St. Simon Sound entrance and bar	590	1-10,000	do	1856-57.
Do.	St. Simon Sound entrance	1775	1-10,000	J. E. Pillsbury, U. S. N.	1887.
Do.	do	1830	1-20,000	do	1888.
Do.	St. Simon Sound entrance, examination of outer bar.	2122	1-20,000	E. M. Hughes, U. S. N.	1892.
Do.	do	2178	1-20,000	L. M. Garrett, U. S. A.	1894.
Do.	St. Simon Sound and Brunswick River to Brunswick Point.	548	1-10,000	S. D. Trenchard	1856.
Do.	Brunswick River and Turtle River	575	1-10,000	do	1856.
Do.	Turtle River	587	1-10,000	do	1857.
Do.	St. Andrew Sound entrance	1333	1-20,000	R. E. Halter and F. P. Webber.	1869-72.
Do.	do	231	1-20,000	J. Rodgers, U. S. N.	1850.
Do.	St. Andrew Sound and Jekyl Sound and vicinity	1020	1-20,000	R. E. Halter	1869.
Georgia and Florida.	St. Andrew Sound to Cumberland Sound	1062	1-20,000	C. Junken	1870.
Do.	St. Mary River entrance and bar	591	1-10,000	S. D. Trenchard, U. S. N.	1855-57.
Do.	St. Mary River Bar and Fernandina Harbor	479	1-20,000	R. Wainwright, U. S. N.	1855.
Do.	St. Mary River entrance and bar	571	1-10,000	S. D. Trenchard, U. S. N.	1857.
Do.	St. Mary River, Main Ship Channel	980	1-20,000	R. E. Halter	1869.
Do.	St. Mary River entrance, river and bar (condemned, see No. 591).	550	1-10,000	S. D. Trenchard, U. S. N.	1857.
Do.	St. Mary River Bar	1218 *b*	1-10,000	F. D. Granger	1874.
Do.	do	1218 *a*	1-10,000	do	1874.
Do.	St. Mary River Bar and Cumberland Channel	1218 *c*	1-10,000	J. C. Kennett, U. S. N.	1875-76.
Do.	St. Mary River entrance and Fernandina Harbor	579	1-10,000	S. D. Trenchard, U. S. N.	1855-57.
Do.	St. Mary River, Cumberland Sound to St. Marys	592	1-10,000	do	1856.
Do.	St. Mary River and estuaries	1112	1-10,000	F. P. Webber	1871.
Florida	Amelia River and tributaries	1111	1-10,000	do	1871.
Do.	Cumberland Sound, River, and tributaries	1063	1-20,000	C. Junken	1870.
Do.	St. Mary River Bar to St. Johns River Bar	1110	1-20,000	F. P. Webber	1871.
Do.	Nassau Sound, River, and tributaries	1113 *a*	1-10,000	do	1871.
Do.	Nassau River above Pumpkin Hill Creek	1113 *b*	1-10,000	do	1871.
Do.	St. Johns River Bar to Diego Plains	1224	1-20,000	F. D. Granger	1874.
Do.	St. Johns River entrance and Fort George Inlet	351	1-10,000	T. A. Craven, U. S. N.	1853.
Do.	St. Johns River Bar and Fort George Inlet	586	1-10,000	S. D. Trenchard, U. S. N	1857.
Do.	St. Johns River Bar (current chart)	511	1-10,000	do	1855.
Do.	St. Johns River Bar, entrance to Pablo Creek	1541	1-10,000	E. D. F. Heald, U. S. N., and U. S. Engineers.	1883-89.
Do.	St. Johns River Bar to Nassau River, inland passage.	1147	1-10,000	F. P. Webber	1872.
Do.	St. Johns River Bar, Mayport Mills to Brown Creek.	481	1-10,000	R. Wainwright, U. S. N.	1855.
Do.	St. Johns River Bar, Pablo Creek to New Castle Island.	1542 *a*	1-10,000	E. D. F. Heald, U. S. N.	1883.
Do.	St. Johns River Bar, Brown Creek to Point Suarrez.	482	1-10,000	R. Wainwright, U. S. N.	1855.
Do.	St. Johns River Bar, Castle Island to Jacksonville	1542 *b*	1-10,000	E. D. F. Heald, U. S. N	1883.
Do.	St. Johns River Bar, Point Suarrez to Winter Point.	484	1-10,000	R. Wainwright, U. S. N.	1855.
Do.	St. Johns River Bar, Jacksonville to Lake Monroe	*2027	1-80,000	H. G. Ogden	1875.
Do.	St. Johns River Bar, Jacksonville to Mandarin Point.	1384 *a*	1-20,000	do	1876-77.
Do.	St. Johns River Bar, Mandarin Point to St. Patricio.	1384 *b*	1-20,000	do	1877.
Do.	St. Johns River Bar, St. Patricio Point to Racey Point.	1389	1-20,000	W. I. Vinal	1878.
Do.	St. Johns River Bar, Racey Point to San Mateo	1636	1-20,000	G. C. Hanus, U. S. N	1885.
Do.	St. Johns River Bar, Lake Monroe to Lake Washington.	*1512	1-80,000	E. Ellicott	1883.

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	CAPE FEAR TO MOSQUITO INLET—continued.				
Florida	Diego Plains to Matanzas Inlet	1266	1-40,000	R. D. Hitchcock, U. S. N	1875.
Do	St. Augustine Harbor and approaches	712	1-10,000	A. Murray, U. S. N.	1860.
Do	do	711	1-10,000	do	1860.
Do	St. Augustine and vicinity	1036	1-10,000	H. Anderson	1870.
Do	North and Guano rivers	1046	1-10,000	do	1870.
Do	Spring off Matanzas Inlet	1267 *a*	1-5,000	R. D. Hitchcock, U. S. N	1875.
Do	do	1267 *b*	1-10,000	do	1875.
Do	Matanzas Inlet and River	1148 *b*	1-5,000	A. M. Harrison	1872.
Do	Matanzas River	1047	1-10,000	H. Anderson	1870.
Do	do	1148 *a*	1-5,000	A. M. Harrison	1872.
Do	Matanzas Inlet to Mosquito Inlet	1365	1-40,000	J. C. Kennett, U. S. N	1876-77.
Do	Mosquito Inlet	260	1-20,000	J. Rodgers, U. S. N.	1851.
Do	Mosquito Inlet and part of Hillsboro and Halifax rivers.	1289 *a*	1-5,000	L. B. Wright	1874.
Do	Halifax River and Rose Bay	1289 *b*	1-5,000	do	1874.
Do	Spruce Creek and Strickland and Turnbull bays	1289 *c*	1-5,000	do	1874.
Do	Halifax River	1232 *a*	1-5,000	A. M. Harrison	1874.
Do	do	1232 *b*	1-5,000	do	1874.
Do	do	1232 *c*	1-5,000	do	1874.
Do	do	1233 *a*	1-5,000	do	1874.
Do	Halifax River, part of Tomoka Creek	1233 *b*	1-5,000	do	1874.
Do	Halifax River, head and tributaries	1234 *a*	1-5,000	do	1874.
Do	Bulow Creek	1234 *b*	1-5,000	do	1874.
	OUTSIDE WATERS FROM MOSQUITO INLET TO VIRGINIA KEY.				
Florida	Mosquito Inlet to False Cape	1409	1-40,000	C. M. Chester, U. S. N	1878.
Do	False Cape to Cape Canaveral	1410	1-20,000	do	1878.
Do	Cape Canaveral Shoals (reconnaissance)	234	1-20,000	J. Rodgers, U. S. N.	1850.
Do	Cape Canaveral Shoals	1411 *a*	1-20,000	C. M. Chester, U. S. N.	1877.
Do	do	1411 *b*	1-20,000	E. B. Thomas, U. S. N.	1881.
Do	Cape Canaveral Shoals to Gibson Cut	1488 *a*	1-40,000	do	1881.
Do	Gibson Cut to La Roche	1488 *b*	1-40,000	do	1881.
Do	La Roche to St. Lucie Shoal	1523 *a*	1-40,000	do	1882-83.
Do	St. Lucie Shoal to Jupiter Inlet	1523 *b*	1-40,000	do	1882-83.
Do	Jupiter Inlet to abreast north end Hypoluxo Island	1552	1-40,000	H. B. Mansfield, U. S. N.	1883.
Do	Abreast north end Hypoluxo Island to Hillsboro Inlet.	1553	1-40,000	do	1883.
Do	Hillsboro Inlet to Virginia Key	1554	1-40,000	do	1883.
	INSIDE WATERS FROM MOSQUITO INLET TO VIRGINIA KEY.				
Florida	Mosquito Inlet	260	1-20,000	J. Rodgers, U. S. N.	1851.
Do	Mosquito Inlet and part of Hillsboro and Halifax rivers.	1289 *a*	1-5,000	L. B. Wright	1874.
Do	Hillsboro River and Mosquito Lagoon	1290	1-10,000	do	1874-75.
Do	Mosquito Lagoon	1291	1-20,000	do	1875.
Do	Haulover Canal between Indian River and Mosquito Lagoon.	*1415 *b*	1-5,000	T. A. Harrison	1875.
Do	Indian River, Addison Point to head of river, and Banana Creek.	1292	1-20,000	C. Hosmer	1875-76.
Do	Banana River, Duck Point to head, and part of Banana Creek.	1415 *a*	1-20,000	R. M. Bache	1878.
Do	Banana River, Duck Point to Mangrove Island	1415 *b*	1-20,000	do	1878.
Do	Indian River, Addison Point to Oleander Point	1293	1-20,000	C. Hosmer	1876.
Do	Banana and Indian rivers and New Found Harbor	1380	1-20,000	do	1876-77.
Do	Indian River, Banana River entrance to Rock Point	1416	1-20,000	R. M. Bache	1878.
Do	Rock Point to Duck Point	1491 *a*	1-20,000	W. I. Vinal	1881.
Do	Indian River, Duck Point to La Roche	1491 *b*	1-20,000	do	1881.
Do	Indian River, La Roche to Indian River Inlet	1513 *a*	1-20,000	C. H. Boyd	1882.
Do	Indian River, Isle No. 1 to Fort Capron	1513 *b*	1-20,000	B. A. Colonna	1883.

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	INSIDE WATERS FROM MOSQUITO INLET TO VIRGINIA KEY—continued.				
Florida	Indian River Inlet	*785	1-10,041	C. Ferguson and J. S. Bradford.	1860-61.
Do	Indian River Inlet to Eden post-office	1570	1-20,000	B. A. Colonna	1883.
Do	Indian River and St. Lucie River to South Jupiter Narrows.	1571 a	1-20,000	....do	1883.
Do	Indian River, Prospect Inlet	1571 b	1-20,000	A. Mertz, U. S. N.	1894.
Do	Hobes Sound, Jupiter Sound, River, and Inlet, from South Jupiter Narrows to head of Lake Worth Creek.	1604 a	1-20,000	B. A. Colonna	1884.
Do	Lake Worth, from Little Lake Worth to Haulover	1604 b	1-40,000	....do	1884.
Do	Lakes Wyman and Boca Ratan, Hillsboro River and Inlet, and north part New River.	1605 a	1-10,000	....do	1884.
Do	New River and Inlet, and north end Biscayne Bay	1605 b	1-20,000	....do	1884.
Do	New River and mouth of Miami River	1545	1-20,000	O. H. Tittmann	1883.
Do	Key Biscayne Bay, Arch Creek to Bears Cut	1329	1-20,000	C. A. Bradbury, U. S. N.	1876.
	OUTSIDE WATERS FROM KEY BISCAYNE TO KEY WEST.				
Florida	Norris Cut to Sands Cut and upper part Key Biscayne Bay.	407	1-20,000	J. Rodgers, U. S. N	1852.
Do	Key Biscayne Bay and Florida Reefs, Sands Cut to Old Rhodes Bank.	369	1-20,000	T. A. Craven, U. S. N.	1853.
Do	Key Biscayne Bay and Card Sound	444	1-20,000	....do	1854.
Do	Pacific Reef to Carysfort Reef	443	1-20,000	....do	1854.
Do	Carysfort Reef to Grecian Shoal	568	1-20,000	....do	1855.
Do	Grecian Shoal to French Reef	553	1-20,000	....do	1856.
Do	Point Charles to middle of Upper Matecumbe Key	777	1-40,000	E. Cordell	1863.
Do	Middle of Upper Matecumbe Key to south end of Lower Matecumbe Key.	774	1-20,000	G. Davidson	1862.
Do	Tennessee Reef to Coffins Patches	773	1-20,000	J. Wilkinson, U. S. N.	1860.
Do	Coffins Patches to Boot Key	714	1-20,000	T. A. Craven, U. S. N.	1859.
Do	Coffins Patches	417	1-20,000	....do	1854.
Do	Boot Key to Bahia Honda	663	1-20,000	W. G. Temple, U. S. N.	1858.
Do	Bahia Honda to Sugar Loaf Key	669	1-20,000	T. A. Craven, U. S. N.	1857.
Do	Loggerhead Key to Eastern Sambo	650	1-20,000	....do	1856.
Do	Key West Harbor and approaches	281	1-20,000	J. Rodgers, U. S. N	1851.
Do	....do	248	1-20,000	....do	1850.
	FLORIDA KEYS TO THE RIO GRANDE.				
Florida	Florida Bay, Bond Sound, Card Sound to Upper Matecumbe Key.	2007	1-40,000	J. F. Moser, U. S. N	1890.
Do	Florida Bay, Bond Sound	*1154	1-40,000	T. G. Oltmans	1870.
Do	....do	*1071	1-30,000	C. T. Iardella	1868.
Do	Florida Bay, Upper Matecumbe Key to Vaca Keys and Cape Sable.	1927	1-40,000	J. F. Moser, U. S. N.	1859.
Do	Florida Bay, north of Rabbit Key	2008	1-40,000	....do	1890.
Do	Florida Bay approaches to Big Spanish and Knight Key channels.	1926	1-20,000	....do	1889-90.
Do	Florida Bay, Content Key to Northwest Cape	1827	1-40,000	....do	1888.
Do	Florida Bay, Content Key to Northwest Passage Light.	1828	1-40,000	....do	1888-89.
Do	Florida Bay, offshore soundings, Key West to Cape Romano Shoals.	1825	1-80,000	....do	1888.
Do	Florida Bay and Keys, Big Pine Key to Key West	2006	1-40,000	....do	1890.
Do	Boca Chica Key (additional lines)	779	1-20,000	E. Cordell	1863.
Do	Key West Harbor and Northwest Channel Bar	1518	1-10,000	W. H. Brownson, U. S. N.	1882.
Do	Key West Harbor	338	1-5,000	J. Rodgers, U. S. N.	1850-51-52.
Do	....do	287	1-5,000	....do	1850-51.
Do	Key West Harbor, Northwest Channel Bar	1925	1-10,000	J. F. Moser, U. S. N.	1889.
Do	Key West Harbor, northwest approaches	1131	1-80,000	R. Platt, U. S. N.	1872.
Do	Boca Grande Channel, Marquesas Keys and vicinity.	359	1-20,000	J. Rodgers, U. S. N.	1852.
Do	Boca Grande Channel, Marquesas Keys	282	1-20,000	....do	1851-52.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Florida	Boca Grande Channel and approaches	912	1-40,000	R. Platt, E. D. F. Heald, and J. M. Hawley, U.S.N.	1876-85-86.
Do.	Marquesas Keys to Dry Tortugas Keys	954	1-80,000	R. Platt, U. S. N.	1867-68.
Do.	....do	1076	1-80,000	....do	1871.
Do.	Marquesas Keys to Rebecca Shoal	1052	1-40,000	....do	1870.
Do.	Rebecca Shoal and line of soundings to Dry Tortugas.	313	1-30,000	J. Rodgers, U. S. N	1852.
Do.	Dry Tortugas Keys and approaches	955	1-40,000	R. Platt, U. S. N.	1867-68.
Do.	Dry Tortugas Keys	1271	1-20,000	....do	1875.
Do.	Dry Tortugas Harbor	1199 *a*	1-5,000	J. A. Howell, U. S. N	1873.
Do.	....do	1199 *b*	1-5,000	....do	1873.
Do.	Northwest Cape to Pavilion Key	1826	1-40,000	J. F. Moser, U. S. N	1888.
Do.	Shark River to Lossmans River	2009	1-20,000	....do	1890.
Do.	Lossmans River to Pavilion Key	2010	1-20,000	....do	1890.
Do.	Pavilion Key to Sand Fly Pass	1774	1-40,000	....do	1887.
Do.	Sand Fly Pass to Cape Romano	1773	1-40,000	....do	1887.
Do.	Pavilion Key to Tiger Key	2011	1-20,000	....do	1890.
Do.	Cape Romano to Gordens Pass	1642	1-40,000	E. D. F. Heald, U. S. N	1885.
Do.	Tiger Key to Cape Romano	2012	1-20,000	J. F. Moser, U. S. N.	1890.
Do.	Caximbas Pass and Bay, lower entrance Big Marco River.	2037	1-10,000	J. Hergesheimer	1890.
Do.	Big Marco Pass and River	2038	1-10,000	....do	1890.
Do.	Gordens Pass to San Carlos Bay entrance	1592 *a, b*	1-40,000	H. B. Mansfield, U. S. N.	1889.
Do.	Sanibel Island, off shore	1478 *a, b*	1-40,000	C. M. Chester, U. S. N.	1879-80.
Do.	San Carlos Bay approaches	1479	1-20,000	....do	1879-80.
Do.	San Carlos Bay and Caloosa entrance	917	1-20,000	W. S. Edwards	1866-67.
Do.	Pine Island Sound and Caloosahatchee approaches	908	1-20,000	C. T. Iardella	1866.
Do.	Caloosa River entrance	2153	1-10,000	W. I. Vinal	1893.
Do.	Caloosa River	2154	1-10,000	....do	1893.
Do.	....do	2155	1-10,000	....do	1893.
Do.	Charlotte Harbor, Matlacha Pass	1480 *b*	1-20,000	C. M. Chester, U. S. N.	1879-80.
Do.	Charlotte Harbor, Pine Island Sound	1480 *a*	1-20,000	....do	1879-80.
Do.	Charlotte Harbor, off shore	1477 *a*	1-40,000	....do	1879-80.
Do.	Charlotte Harbor, off shore (outside of 1477 *a*)	1477 *b*	1-40,000	....do	1879-80.
Do.	Charlotte Harbor approaches	1479 *b*	1-20,000	....do	1879-80.
Do.	Charlotte Harbor, Boca Grande entrance	797 *a*	1-40,000	E. Cordell	1863.
Do.	Charlotte Harbor, Boca Grande entrance, inside	797 *b*	1-20,000	W. S. Edwards	1867.
Do.	Charlotte Harbor, Pine Island to Punta Gorda	1388 *a*	1-20,000	J. M. Hawley, U. S. N.	1878.
Do.	Charlotte Harbor, upper part, and Pea Creek	1388 *b*	1-20,000	....do	1878.
Do.	Bocilla Pass to New Pass	1557 *b*	1-40,000	H. B. Mansfield, U. S. N	1883.
Do.	Lemon Bay, Bocilla Inlet to Stump Pass	1595 *a*	1-80,000	....do	1884.
Do.	Lemon Bay, Stump Pass to head of bay	1595 *b*	1-20,000	....do	1884.
Do.	New Pass to Longboat Inlet	1314 *a*	1-40,000	J. M. Hawley, U. S. N.	1886.
Do.	Little Sarasota Bay	1559 *b*	1-20,000	J. Hergesheimer	1883.
Do.	Sarasota Bay	1559 *a*	1-20,000	....do	1883.
Do.	New Pass to Longboat Inlet	1314 *a*	1-40,000	J. M. Hawley, U. S. N.	1876.
Do.	Longboat Inlet and Bar	1314 *b*	1-40,000	....do	1876.
Do.	Anna Maria Key, off shore, south of Tampa Bay	1486 *b*	1-40,000	E. B. Thomas, U. S. N.	1881.
Do.	Tampa Bay, off shore	1486 *a*	1-40,000	....do	1881.
Do.	Tampa Bay approaches	1262	1-20,000	R. Platt, U. S. N.	1874-75.
Do.	Tampa Bay (reconnaissance)	478	1-60,000	O. H. Berryman, U. S. N.	1855.
Do.	Tampa Bay, Passage Key to Beacon No. 5	1235 *a*	1-20,000	Andrew Braid	1874.
Do.	Tampa Bay, Beacon No. 5 to Papys Bayou	1235 *b*	1-20,000	Andrew Braid and H. B. Mansfield, U. S. N.	1874-83.
Do.	Old Tampa Bay, Hillsboro Bay approaches, and Little Manatee and Big and Little bays.	1273	1-20,000	J. Hergesheimer and H. G. Ogden.	1875.
Do.	Hillsboro Bay	1313	1-20,000	J. M. Hawley, U. S. N.	1876.
Do.	Manatee River Bar	1555	1-10,000	H. B. Mansfield, U. S. N.	1883.
Do.	Manatee River, Palmasola Bay and Pass, Terra Ceia and McGill Bay and Bishop Harbor.	1272	1-20,000	Andrew Braid and J. Hergesheimer.	1874-75.
Do.	Boca Ceiga Bay, Tampa Bay to Johns Pass	1178 *a*	1-20,000	Andrew Braid	1873.
Do.	Boca Ceiga Bay, Johns Pass to Indian Pass	1178 *b*	1-20,000	....do	1873.
Do.	Blind Pass to Big Pass	1557 *a*	1-40,000	H. B. Mansfield, U. S. N.	1883.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Florida	Big Pass to Deer Island	1593 *a, b*	1-40,000	H. B. Mansfield, U. S. N.	1883.
Do	Clearwater Harbor	1174	1-20,000	H. G. Ogden	1873.
Do	Anclote River	1594	1-10,000	H. B. Mansfield, U. S. N.	1884.
Do	Deer Island to Rainbow Point	1760	1-40,000	J. M. Hawley, U. S. N.	1886.
Do	Rainbow Point to Chassahowitzka Bay	1761	1-40,000	.....do	1886.
Do	Chassahowitzka Bay, Crystal River	1770	1-40,000	J. F. Moser, U. S. N.	1887.
Do	Crystal River to Cedar Keys	1771	1-40,000	.....do	1887.
Do	Cedar Keys to Steinhatchee River	1928	1-80,000	.....do	1889.
Do	Waccasasa Bay	531	1-20,000	J. K. Duer, U. S. N.	1856.
Do	.....do	581	1-20,000	.....do	1857.
Do	Waccasasa Bay (compiled)	1641	1-20,000	O. H. Berryman and J. K. Duer, U. S. N., and F. W. Perkins.	1854-55-56-57-77.
Do	Cedar Keys	424	1-20,000	O. H. Berryman, U. S. N.	1854.
Do	.....do	512	1-20,000	.....do	1855.
Do	.....do	513	1-20,000	.....do	1855.
Do	Cedar Keys, channel near North Key	304	1-10,000	F. H. Gerdes	1852.
Do	Cedar Keys, Main, North Key, and West channels	668	1-10,000	T. B. Huger, U. S. N.	1858-59.
Do	Cedar Keys	713	1-10,000	J. J. Guthrie, U. S. N.	1860.
Do	Cedar Keys, Northwest and Sea-Horse channels (re-plotting of No. 713).	716	1-10,000	.....do	1860.
Do	Cedar Keys, Main Channel	1080	1-10,000	F. P. Webber	1871.
Do	Cedar Keys Harbor, examination of entrance bar	1772 *a*	1-20,000	J. F. Moser, U. S. N.	1887.
Do	Cedar Keys Harbor, examination of Middleground Cut.	1772 *b*	1-10,000	.....do	1887.
Do	Derrick Bay to Big Pine Island	1377 *ab*	1-20,000	F. W. Perkins	1877.
Do	Big Pine Island to Pepperfish Key	1376	1-20,000	.....do	1677.
Do	Pepperfish Key to Deadmans Bay	1280 *b*	1-20,000	.....do	1874-75.
Do	Deadmans Bay to Live Oak Point	1280 *a*	1-20,000	.....do	1875.
Do	Steinhatchee River to Dog Island	1929	1-80,000	J. F. Moser, U. S. N.	1889.
Do	Live Oak Point to Fenholloway River	1279 *b*	1-20,000	F. W. Perkins	1875.
Do	Fenholloway River to Ancilla River	1279 *a*	1-20,000	.....do	1875.
Do	Appalachee Bay, off shore	1332	1-40,000	K. Niles, U. S. N.	1876.
Do	Appalachee Bay, off Light-House Point	1489	1-40,000	E. B. Thomas, U. S. N.	1881.
Do	Appalachee Bay and Ancilla River approaches	517	1-10,000	O. H. Berryman, U. S. N.	1855.
Do	Appalachee Bay and Ancilla River to St. Mark River.	1330 *b*	1-20,000	K. Niles, U. S. N.	1876.
Do	Appalachee Bay, St. Mark River to Ocklockonee Bay.	1331 *a*	1-20,000	.....do	1876.
Do	Appalachee Bay, St. Mark River approaches	540	1-20,000	O. H. Berryman, U. S. N.	1856.
Do	Appalachee Bay, St. Mark River and Channel to railroad depot.	305	1-20,000	F. H. Gerdes	1852.
Do	Appalachee Bay, St. Mark River	541	1-10,000	O. H. Berryman, U. S. N.	1856.
Do	.....do	1330 *a*	1-10,000	K. Niles, U. S. N.	1875.
Do	Appalachee Bay, Ocklockonee Bay, Ocklockonee Point to Dog Island Reef.	1331 *b*	1-20,000	.....do	1876.
Do	Appalachee Bay, Ocklockonee Bay, Crooked River	1390	1-20,000	J. Hergesheimer	1878.
Do	St. Georges Sound, off shore, Southwest Cape to East Pass.	1156	1-20,000	H. Anderson	1872.
Do	St. Georges Sound, off shore, south end of St. George Island to Cape St. George.	1184	1-40,000	.....do	1873.
Do	Cape St. George to Cape San Blas	1265 *b*	1-40,000	H. Anderson and K. Niles, U. S. N.	1874-75.
Do	St. Georges Sound, Alligator Harbor to Dog Island	734	1-20,000	T. S. Phelps, U. S. N.	1860.
Do	St. Georges Sound, south of Dog Island, approaches.	688	1-20,000	J. K. Duer, U. S. N.	1858-59.
Do	St. Georges Sound, East Pass	655	1-20,000	.....do	1858.
Do	St. Georges Sound, East Pass approaches	1509	1-20,000 1-10,000	W. H. Brownson, U. S. N.	1882.
Do	St. Georges Sound and Appalachicola Bay and East Bay (compiled).	1092 307	1-20,000 1-200,000	H. Anderson F. H. Gerdes	1871. 1862.
Do	Appalachicola Bay, West Pass	654	1-20,000	J. K. Duer, U. S. N.	1858.
Do	Appalachicola Bay	747	1-20,000	T. S. Phelps, U. S. N.	1860.
Do	Appalachicola Bay, Appalachicola River entrance	*601	1-20,000	G. D. Wise	1857.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Florida	Appalachicola Bay, Appalachicola River entrance	687	1-20,000	J. K. Duer, U. S. N	1859.
Do	Appalachicola Bay, St. Vincent Sound	1241	1-20,000	H. Anderson	1874.
Do	Cape St. George to Cape San Blas	1511 *a*	1-40,000	W. H. Brownson, U. S. N	1882.
Do	Cape St. George to Cape San Blas, off shore	1265 *b*	1-40,000	H. Anderson and K. Niles, U. S. N.	1874-75.
Do	Cape San Blas to St. Andrew Bay	1511 *b*	1-40,000	W. H. Brownson, U. S. N	1881-82.
Do	Cape San Blas to St. Andrew Sound	1265 *a*	1-20,000	K. Niles, U. S. N	1875.
Do	St. Andrew Bay to Phillips Inlet	1373 *b*	1-40,000	R. D. Hitchcock, U. S. N	1877.
Do	St. Andrew Bay	514	1-20,000	O. H. Berryman, U. S. N	1855.
Do	St. Andrew Bay (additional soundings)	518	1-20,000	do	1856.
Do	St. Andrew Bay and entrance	1375	1-20,000	R. D. Hitchcock, U. S. N	1877.
Do	St. Andrew Bay, North and West arms	1374 *a*	1-20,000	do	1877.
Do	St. Andrew Bay, East Bay and Sound	1374 *b*	1-20,000	do	1877.
Do	Phillips Inlet to Santa Rosa Island	1373 *a*	1-40,000	do	1877.
Do	Choctawhatchee Bay, West End Narrows and Santa Rosa Sound.	1107	1-20,000	H. G. Ogden	1871.
Do	Choctawhatchee Bay	1141	1-20,000	do	1871.
Do	Choctawhatchee Bay to 15 miles east of Pensacola entrance.	1309	1-40,000	R. D. Hitchcock, U. S. N	1875-76.
Do	15 miles east of Pensacola entrance to Perdido River entrance.	1308	1-40,000	do	1875-76.
Do	Pensacola, entrance and bay	585	1-20,000	J. K. Duer, U. S. N	1856.
Do	Pensacola Bay entrance	1497	1-10,000	W. H. Brownson, U. S. N	1881.
Do	Pensacola Bay, near entrance	719	1-10,000	T. A. Craven, U. S. N	1860.
Do	Pensacola Bay, Santa Rosa Sound, Deer Point to Pritchard Long Point.	1108	1-20,000	H. G. Ogden	1871.
Do	Pensacola Bay	2186	1-10,000	A. Mertz	1894.
Do	do	2217	1-10,000	R. Peck, U. S. N	1895.
Do	Pensacola Bay, Escambia Bay	732	1-20,000	T. S. Phelps, U. S. N	1860.
Do	do	2180	1-10,000	F. J. Swift, U. S. N	1894.
Do	Pensacola Bay, Escambia Bay, proposed site for navy-yard.	1932	1-5,000	P. A. Walker	1889.
Do	Pensacola Bay, Escambia Bay, upper part	2013	1-10,000	do	1891.
Do	Pensacola Bay, East Bay	731	1-20,000	T. S. Phelps, U. S. N.	1860.
Do	do	2218	1-10,000	R. Peck, U. S. N	1895.
Do	Pensacola Bay, East Bay, upper part	2219	1-10,000	do	1895.
Do	Pensacola Bay, Blackwater Bay, Blackwater River	2117	1-10,000	P. A. Walker	1892.
Do	Pensacola Bay	2135	1-10,000	do	1893.
Do	Pensacola Bay, East River	2182	1-10,000	F. J. Swift, U. S. N	1894.
Do	Pensacola Bay, bayous Texar and Chico	2088	1-10,000	P. A. Walker	1890.
Do	Pensacola Bay	2026	1-10,000	do	1889.
Do	Pensacola Bay, Big Lagoon	2181	1-10,000	F. J. Swift, U. S. N	1894.
Alabama	Perdido Bay, entrance to Little Lagoon	1310	1-40,000	R. D. Hitchcock	1875-76.
Florida and Alabama.	Perdido Bay entrance and Bayou St. John and Bay La Launch.	2017	1-10,000	S. Forney	1890.
Do	Perdido Bay	2018	1-10,000	do	1890.
Do	Perdido Bay, Bayou Garcon to head of bay	2074	1-10,000	do	1891.
Do	Perdido Bay and River to Blackwater River	2075	1-10,000	do	1891.
Alabama	Perdido Bay, Wolf Bay and tributaries	2073	1-10,000	do	1891.
Do	Little Lagoon to St. Andrew Bay	262	1-20,000	B. F. Sands, U. S. N	1851.
Do	Mobile Bay, approaches and entrance	192	1-20,000	C. P. Patterson, U. S. N	1847-48
Do	Mobile Bay entrance	2124	1-20,000	E. M. Hughes, U. S. N	1892.
Do	Mobile Bay, entrance between Dauphin and Pelican islands.	361	1-20,000	B. Sands, U. S. N	1853.
Do	Mobile Bay entrance, Pelican Channel	467	1-20,000	do	1855.
Do	Mobile Bay, lower part	193	1-20,000	C. P. Patterson, U. S. N	1848.
Do	Mobile Bay, lower part, Grants Pass and entrance to Dredged Channel.	2125	1-20,000	E. M. Hughes, U. S. N	1892.
Do	Mobile Bay, Bon Secour Bay	263	1-20,000	J. Alden, U. S. N	1851.
Do	Mobile Bay, Alabama Port to Great Point Clear	215	1-20,000	C. P. Patterson, U. S. N	1849.
Do	Mobile Bay, Great Point Clear to Dog River Point.	227	1-20,000	J. Alden, U. S. N	1850.
Do	Mobile Bay, upper part	214	1-10,000	C. P. Patterson, U. S. N	1849.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Alabama	Mobile Bay, Tensaw, Spanish, and Dog rivers	737	1-10,000	J. Wilkinson, U. S. N	1860.
Do	Mobile Bay, Dredged Channel, lower part	1613 *b*	1-20,000	E. D. F. Heald, U. S. N	1885.
Do	Mobile Bay, Dredged Channel, upper part	1613 *a*	1-20,000	....do	1885.
Do	Mobile Bay, Dredged Channel	2128	1-20,000	E. M. Hughes, U. S. N	1892.
Do	Mobile Bay, upper part	228	1-10,000	J. Alden, U. S. N	1850.
Do	....do	229	1-10,000	....do	1850.
Do	Mobile Bay (current chart)	1969	1-20,000 1-40,000	H. Mitchell	1860.
Do	Mobile Bay, Mobile River, Spanish River to Bayou Carnot.	1909	1-5,000	J. H. Turner	1888.
Do	Mobile Bay, Mobile River, Bayou Carnot, Louisville and Nashville Railroad.	1910	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, Louisville and Nashville Railroad Bridge to 1½ miles below Lizard Creek.	1911	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, 1½ miles below Lizard Creek to 1 mile above Bayou Carnot.	1912	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, 1 mile above Bayou Carnot to one-half mile above White House Bend.	1913	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, one-half mile above White House Bend to 2 miles below Cedar Creek.	1914	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, 2 miles below Cedar Creek to Tensaw River.	1915	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, Tensaw River to 1½ miles above Barrow Lake entrance.	1916	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, 1½ miles above Barrow Lake entrance to Alabama River.	1917	1-5,000	....do	1888.
Do	Mobile Bay, Mobile River, Spanish River to Alabama River (diagram sheet).	1918	1-40,000	....do	1888.
Do	Mobile Bay oyster beds	2220	1-40,000	H. P. Ritter	1895.
Do	Dauphin Island and Petit Bois Island, outside	261	1-20,000	B. F. Sands, U. S. N	1851.
Alabama and Mississippi.	Horn Island Pass, approaches	327	1-20,000	....do	1852.
Mississippi	Horn and Ship islands, south shore	430	1-20,000	....do	1854.
Alabama	Mississippi Sound, Grant Pass to west end of Dauphin Island.	191	1-20,000	C. P. Patterson, U. S. N	1847.
Do	Mississippi Sound, Dauphin Island to Grand Bay	329	1-20,000	B. F. Sands, U. S. N	1852.
Alabama and Mississippi.	Mississippi Sound, Grand Bay to Round Island,	328	1-20,000	....do	1853.
Mississippi	Mississippi Sound, Horn Island Pass	1666	1-20,000	J. M. Hawley, U. S. N	1886.
Do	....do	362	1-20,000	B. F. Sands, U. S. N	1853.
Do	Mississippi Sound, Horn Island, north shore	190	1-20,000	C. P. Patterson, U. S. N	1846.
Do	Mississippi Sound, Round Island to east end Horn Island and Pascagoula River.	365	1-20,000	B. F. Sands, U. S. N. and U. S. Engineers.	1855-59.
Do	Mississippi Sound, West Point to Mississippi City	489	1-20,000	....do	1855.
Do	Mississippi Sound, Biloxi Bay	485	1-10,000	B. F. Sands, U. S. N	1855.
Do	Mississippi Sound and Cat Island and Ship Island harbors.	194	1-20,000	C. P. Patterson, U. S. N	1884.
Do	Mississippi Sound, Mississippi City to Cat Island Light.	488	1-20,000	B. F. Sands, U. S. N	1855.
Do	Mississippi Sound, Cat Island Light to Grand Island and St. Louis Bay.	546	1-20,000	....do	1856.
Do	Mississippi Sound, southwest part, and Pass Christian.	589	1-20,000	....do	1857.
Do	Mississippi Sound, Pass Christian	256	1-10,000	....do	1851.
Louisiana	Lake Borgne	1055 *a*	1-40,000	F. P. Webber	1870.
Mississippi and Louisiana.	Grand Island Pass and Pearl River entrance	545	1-20,000	B. F. Sands, U. S. N	1856.
Louisiana	Lake Borgne (part of 1055 *a* enlarged)	1055 *c*	1-20,000	F. P. Webber	1870.
Do	The Rigolets, Pearl River, and Little Lake	671	1-10,000	W. S. Gilbert	1876.
Do	The Rigolets, Pearl River, and Little and St. Catherine lakes, Chef Menteur Pass.	1054	1-20,000	F. P. Webber	1870.
Do	Lake Pontchartrain, eastern part	1053 *b*	1-40,000	....do	1870.
Do	Lake Pontchartrain	1115	1-40,000	J. S. Bradford	1871.

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Louisiana	Chandeleur Island, east coast, and Chandeleur Sound.	1654	1-80,000	E. D. F. Heald, U. S. N., and J. M. Hawley, U.S.N.	1885-86.
Do	Mississippi River approaches	1152	1-40,000	F. D. Granger	1872.
Do	Chandeleur Sound and Nassau Roads	598	1-20,000	B. F. Sands, U. S. N	1857.
Do	Chandeleur Sound, Nassau Roads, and Quarantine Anchorage.	363	1-10,000	....do	1852-53.
Do	Chandeleur Sound, west of Chandeleur Island	1171	1-40,000	F. D. Granger	1873.
Do	Breton Sound	1000	1-40,000	F. P. Webber	1869.
Do	Mississippi River approaches	1116	1-40,000	J. S. Bradford	1871.
Do	....do	1965	1-40,000	C. D. Sigsbee, U. S. N	1874-75.
Do	Mississippi River approaches, Southwest Pass to Ship Jack Bay.	1765	1-40,000	F. H. Crosby, U. S. N	1886.
Do	Mississippi River approaches, Ship Jack Bay to Barataria Bay.	1766	1-40,000	....do	1886.
Do	Mississippi River approaches, Pass à Loutre	715	1-20,000	J. J. Guthrie, U. S. N	1860.
Do	Mississippi River approaches, Main Pass	1386 *b*	1-4,800	H. L. Marindin	1877.
Do	....do	1386 *a*	1-4,800	....do	1877.
Do	Mississippi River approaches, Cubits Gap	1325	1-4,800	....do	1876.
Do	Mississippi River approaches, Cubits Gap, The Jump, South Pass, Bayou Grande, and South Pass Bar.	1251 *b*	1-4,800	....do	1875.
Do	Mississippi River approaches, Pass à Loutre	927	1-10,000	F. H. Gerdes	1877.
Do	Mississippi River approaches, Pass à Loutre, Northeast and Southeast passes.	255	1-20,000	B. F. Sands, U. S. N	1851.
Do	Mississippi River approaches, Northeast and Southeast passes.	926	1-10,000	F. H. Gerdes	1867.
Do	Mississippi River approaches, Pass à Loutre and Southeast Pass.	989	1-20,000	....do	1867.
Do	Mississippi River approaches, Garden Island Bay, East and West bays.	991	1-40,000	F. P. Webber	1868.
Do	Mississippi River approaches, South Pass, outside of bar.	1251 *d*	1-20,000	H. L. Marindin	1875.
Do	Mississippi River approaches, South Pass, off jetties.	1320	1-4,800 / 1-7,684	H. L. Marindin and U. S. Engineers.	1876-78.
Do	Mississippi River approaches, South Pass Bar	1252	1-2,400	H. L. Marindin	1875.
Do	....do	925	1-10,000	F. H. Gerdes	1867.
Do	Mississippi River approaches, South and Southwest passes.	330	1-20,000	B. F. Sands, U. S. N	1852.
Do	Mississippi River approaches, South Pass, East Point to Bayou Grande.	1250 *b*	1-4,800	H. L. Marindin	1875.
Do	Mississippi River approaches, South Pass	990	1-20,000	F. H. Gerdes	1867.
Do	....do	1251 *c*	1-4,800	H. L. Marindin	1875.
Do	Mississippi River approaches, Southwest Pass	923	1-20,000	F. H. Gerdes	1867.
Do	Mississippi River approaches, South Pass, Bayou Grande to Head of Passes.	1250 *a*	1-4,800	H. L. Marindin	1875.
Do	Mississippi River approaches, Southwest Pass and bar.	924	1-10,000	F. H. Gerdes	1867.
Do	Mississippi River approaches, Southwest and South passes.	330	1-20,000	B. F. Sands, U. S. N	1852.
Do	Mississippi River approaches, Southwest Pass, The Cut to three-fourths of a mile below Double Bayou.	1387 *ab*	1-4,800	H. L. Marindin	1877.
Do	Mississippi River approaches, Southwest Pass, near Double Bayou (current chart).	1991	1-4,800	....do	1876.
Do	Mississippi River approaches, Southwest Pass, Scotts House to Double Bayou (current chart).	1990	1-4,800	....do	1876.
Do	Mississippi River approaches, Southwest Pass, Head of Passes to Scotts House (current chart).	1989	1-4,800	....do	1876.
Do	Mississippi River approaches, Southwest Pass, Cutoff to Head of Passes.	1385 *b*	1-4,800	....do	1877.
Do	Mississippi River approaches, Grand Pass	1585	1-30,000	C. Hosmer	1884.
Do	Mississippi River approaches, Grand Pass, The Jump.	1251 *a*	1-4,800	H. L. Marindin	1875.
Do	Mississippi River, Head of Passes to Cubits Gap	922	1-10,000	F. H. Gerdes	1866.
Do	Mississippi River, Head of Passes	1253	1-2,400	H. L. Marindin	1875.
Do	Mississippi River, Head of Passes to Cubits Gap	1385 *a*	1-4,800	....do	1877.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Louisiana	Mississippi River, cross section near Cubits Gap	1992	1–2,400	H. L. Marindin	1877.
Do	do	1993	1–2,400	do	1877.
Do	Mississippi River, Cubits Gap to Point Pleasant	1153	1–20,000	F. G. Granger	1872.
Do	Mississippi River, Point Pleasant to Bohemia	1093	1, 20,000	C. H. Boyd	1871.
Do	Mississippi River, Bohemia to Poverty Point	1154	1–20,000	do	1872.
Do	Mississippi River, Poverty Point to Scarsdale	1192	1–20,000	do	1873.
Do	Mississippi River, Scarsdale to New Orleans	1274	1–20,000	do	1873–74.
Do	Mississippi River, New Orleans to Soniat Rice Mills.	1307 *a*	1–20,000	do	1875–76.
Do	Mississippi River, Soniat Rice Mills to Belle Point	1443 *a*	1–20,000	do	1876–77.
Do	Mississippi River, Bonnet Carré Crevasse	1307 *b*	1–20,000	do	1875–76.
Do	do	1442 *a*	1–5,000	C. M. Chester, U. S. N.	1879.
Do	Mississippi River, Belle Point to Grandview Reach	1343 *b*	1–20,000	C. H. Boyd	1876–77.
Do	Mississippi River, Grandview Reach to Donaldsonville.	1408	1–20,000	C. M. Chester, U. S. N.	1879.
Do	Mississippi River, Merchants Estate to Donaldsonville.	1492 *a*	1–5,000	U. Sebree, U. S. N.	1881.
Do	Mississippi River, Donaldsonville to Dicharys Plantation.	1492 *b*	1–5,000	do	1881.
Do	Mississippi River, Dicharys Plantation to Houmas House.	1493 *a*	1–5,000	do	1881.
Do	Mississippi River, Houmas House to Rescue Plantation.	1493 *b*	1–5,000	do	1881.
Do	Mississippi River, Rescue Plantation to Belle Grove	1494 *a*	1–5,000	do	1881.
Do	Mississippi River, Belle Grove to Randolphs House	1494 *b*	1–5,000	do	1881.
Do	Mississippi River, Randolphs House to Palo Alto	1495 *a*	1–5,000	do	1881.
Do	Mississippi River, Palo Alto to Ventress	1495 *b*	1–5,000	do	1881.
Do	Mississippi River, Ventress to Battine	1496	1–5,000	do	1881.
Mississippi	Mississippi River, Morganza Crevasse	1442 *b*	1–5,000	C. M. Chester, U. S. N.	1879.
Do	Mississippi River, Cornpen Bend	1442 *c*	1–5,000	do	1879.
Do	Mississippi River, Grand Gulf and vicinity	846	1–5,000	F. H. Gerdes	1864.
Do	Mississippi River, Diamond Island Crevasse	1442 *d*	1–5,000	C. M. Chester, U. S. N.	1879.
Illinois and Kentucky.	Ohio River, Cairo to Mound City	851	1–10,000	F. H. Gerdes	1864.
Louisiana	Shell Bay to Ronquille Bay	1546	1–30,000	C. H. Boyd	1883.
Do	Barataria Bay approaches	1383 *a*	1–20,000	W. I. Moore, U. S. N.	1878.
Do	Barataria Bay entrance	1383 *b*	1–10,000	do	1878.
Do	Barataria Bay, bar and harbor	441	1–10,000	F. H. Gerdes	1853.
Do	Barataria Bay	1382	1–20,000	W. I. Moore, U. S. N.	1878.
Do	Barataria Bay, Timbalier, Terrebonne, and Caillou bays.	442	1–20,000	F. H. Gerdes	1853.
Do	Barataria Bay, Wilkins Bayou and tributaries	2091	1–20,000	W. H. Dennis	1878.
Do	Barataria Bay to Isle Derniere	2069	1–80,000	E. M. Hughes, U. S. N.	1891.
Do	Camida Pass to Raccoon Pass	2072	1–20,000	do	1891.
Do	Isle Derniere, south shore	2014	1–80,000	A. L. Hall, U. S. N.	1889–90.
Do	Ship Shoal Light to Marsh Island	1831	1–80,000	F. H. Crosby and L. M. Garrett, U. S. N.	1888–89.
Do	Timbalier Bay and approaches	2071	1–20,000	E. M. Hughes, U. S. N.	1891.
Do	Terrebonne Bay and approaches	2070	1–20,000	do	1891.
Do	Ship Island Shoal, off Isle Derniere	360	1–20,000	B. F. Sands, U. S. N.	1853.
Do	Isle Derniere, south shore	2015	1–20,000	A. L. Hall, U. S. N.	1889–90.
Do	Caillou Bay and approaches	2016	1–20,000	do	1890.
Do	Atchafalaya Bay, approaches	1933	1–20,000	L. M. Garrett, U. S. N.	1889.
Do	Atchafalaya Bay	658	1–20,000	B. F. Sands, U. S. N.	1858.
Do	Atchafalaya Bay, approaches	680	1–20,000	T. B. Huger, U. S. N.	1859.
Do	Atchafalaya Bay, Dredged Channel	1763	1–10,000	D. D. V. Stewart, U. S. N.	1887.
Do	do	1762	1–10,000	do	1887.
Do	Atchafalaya Bay and River to Sword Point	1823	1–10,000	C. H. Sinclair	1888.
Do	Atchafalaya Bay and River to Morgan City	1824	1–10,000	do	1888.
Do	East Coté Blanche Bay	682	1–20,000	T. B. Huger, U. S. N.	1859.
Do	West Coté Blanche Bay	1767	1–20,000	F. H. Crosby, U. S. N.	1886.
Do	Marsh Island to Joseph Harbor Bayou	1776	1–80,000	D. D. V. Stewart and F. H. Crosby, U. S. N.	1887–88.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Louisiana	Trinity and Tiger shoals	1139 *a, b*	1-40,000	F. D. Granger	1872.
Do	Vermilion Bay entrance	486	1-20,000	B. F. Sands, U. S. N.	1855.
Do	Vermilion Bay, Southwest Pass to Point Gracious	1777	1-20,000	D. D. V. Stewart and F. H. Crosby, U. S. N.	1887-88.
Do	Vermilion Bay, middle part	1821	1-20,000	F. H. Crosby, U. S. N.	1888.
Do	Vermilion Bay, upper part, Wicks Bay, Petite Anse Bayou.	1819	1-20,000	.....do	1888.
Do	Vermilion Bay, western part	1822	1-20,000	.....do	1888.
Do	Joseph Harbor Bayou to Johnsons Bayou	1645	1-80,000	.....do	1885.
Do	Calcasieu Pass to the High Islands	1596 *a*	1-80,000	E. D. F. Heald, U. S. N.	1884.
Do	Mermentau River	1647	1-20,000	F. H. Crosby, U. S. N.	1885.
Do	Calcasieu River	487	1-20,000	B. F. Sands, U. S. N.	1855.
Do	Calcasieu Pass	1648	1-20,000	F. H. Crosby, U. S. N.	1885.
Do	Calcasieu Pass to Leesburg	1572	1-10,000	L. Flynne, U. S. N.	1883.
Louisiana and Texas.	Sabine Pass	1596 *b*	1-20,000	G. C. Hanus, U. S. N	1884.
Do	.....do	1646 *b*	1-20,000	F. H. Crosby, U. S. N.	1885.
Do	Sabine Pass and Lake	1646 *a*	1-20,000	.....do	1885.
Texas	Coast of Texas, High Islands to Galveston entrance.	1556 *a, b*	1-80,000	E. M. Hughes, U. S. N.	1883.
Do	Galveston approaches	471	1-20,000	E. J. De Haven, U. S. N.	1855.
Do	Galveston Bar and Harbor	247	1-20,000	A. S. Baldwin, U. S. N	1850.
Do	Galveston entrance	265	1-20,000	T. A. Craven, U. S. N.	1851-52.
Do	.....do	906 *a*	1-10,000	F. F. Nes	1867.
Do	Galveston entrance and Bay (reduction of Nos. 906 and 919).	906 *b*	1-20,000	F. F. Nes and C. H. Boyd	1867.
Do	Galveston entrance and Bay	264	1-20,000	T. A. Craven, U. S. N.	1851.
Do	Galveston entrance	1530	1-10,000	E. M. Hughes, U. S. N.	1883.
Do	Galveston entrance, outer bar to southward and westward.	1597 *a*	1-20,000 1-80,000	E. D. F. Heald, U. S. N., and G. C. Hanus, U. S. N.	1884.
Do	Galveston entrance and Harbor	919	1-10,000	C. H. Boyd	1867.
Do	Galveston Bay, lower part	918 *a*	1-20,000	F. F. Nes	1867.
Do	Galveston Bay (comparative chart)	918 *b*	1-10,000	T. A. Craven, U. S. N., and F. F. Nes.	1851-67.
Do	Galveston Bay, lower part	323	1-20,000	T. A. Craven, U. S. N.	1852.
Do	Galveston Bay to Red Fish Bar	324	1-20,000	.....do	1852.
Do	Galveston Bay, East Bay	425	1-20,000	E. J. De Haven, U. S. N.	1854.
Do	Galveston Bay, Smith Point to San Juncite Bay	414	1-20,000	H. S. Stellwagen, U. S. N.	1853.
Do	Galveston Bay, Smith Point, Turtle Bay	470	1-20,000	E. J. De Haven, U. S. N.	1855.
Do	Galveston Island, south shore	472	1-20,000	.....do	1855.
Do	San Luis Pass to Oyster Creek	473	1-20,000	.....do	1855.
Do	San Luis Pass	389	1-10,000	H. S. Stellwagen, U. S. N.	1853.
Do	West Bay, San Luis Bay to Hall Lake	931	1-20,000	F. F. Nes	1867.
Do	West Bay, Hall Lake to railroad bridge	932	1-20,000	.....do	1867.
Do	Brazos River entrance	474	1-20,000	E. J. De Haven, U. S. N.	1855.
Do	.....do	2102	1-10,000	H. G. Ogden	1891.
Do	.....do	656	1-10,000	J. K. Duer, U. S. N.	1858.
Do	Brazos River to Smith Landing	539	1-20,000	E. J. De Haven, U. S. N.	1856.
Do	Matagorda Peninsula, south shore	1427 *a*	1-40,000	T. F. Jewell, U. S. N.	1879.
Do	Matagorda Peninsula and Island, south shore, and Pass Cavallo.	1427 *b*	1-40,000	.....do	1879.
Do	Matagorda Bay entrance, Pass Cavallo	635	1-20,000	J. C. Febiger, U. S. N.	1858.
Do	.....do	1231	1-10,000	L. B. Wright	1874.
Do	.....do	1097	1-20,000	F. D. Granger	1871.
Do	.....do	588	1-20,000	J. C. Febiger, U. S. N.	1856.
Do	Matagorda Bay to Oyster Lake	1031	1-20,000	F. P. Webber and F. D. Granger.	1866-71.
Do	Matagorda Bay, Oyster Lake to Matagorda	689	1-20,000	J. K. Duer, U. S. N	1859.
Do	Matagorda Bay, Matagorda to Cany Creek Canal	1161	1-20,000	L. B. Wright	1871-72.
Do	Matagorda Bay, Tres Palacios and Turtle bays	1094	1-20,000	F. D. Granger	1871.
Do	Matagorda Bay, western part	727	1-20,000	W. Ronckendorff, U. S. N.	1860.
Do	Matagorda Bay, Carankaway Bay	1095	1-20,000	F. D. Granger	1871.

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	FLORIDA KEYS TO THE RIO GRANDE—continued.				
Texas	Matagorda Bay, Laroca Bay	1098	1-20,000	R. E. Halter and F. D. Granger.	1868-71.
Do	Espiritu Santo, San Antonio, Aransas and Capano bays.	*720	1-50,000	S. A. Gilbert	1858.
Do	Espiritu Santo Bay	1096	1-20,000	L. B. Wright	1873.
Do	San Antonio Bay	1268	1-20,000	L. B. Wright and W. I. Vinal.	1873-74-75.
Do	Matagorda and St. Joseph islands, southeast shores	1464	1-40,000	U. Sebree, U. S. N	1880.
Do	St. Joseph Island to Mustang Island, southeast shores	1465	1-40,000	.....do	1880.
Do	Mezquit and Aransas bays	1286	1-20,000	R. Wainwright, U. S. N., and W. I. Vinal.	1875.
Do	Capano and St. Charles bays	1287	1-20,000	R. Wainwright, U. S. N	1875.
Do	Aransas Pass	2054	1-10,000	E. M. Hughes, U. S. N	1891.
Do	Aransas Pass and Steamboat Channel between Aransas and Corpus Christi bays.	1288 *a*	1-10,000 1-20,000	R. Wainwright, U. S. N	1875.
Do	Aransas Pass	996	1-10,000	F. F. Nes	1868.
Do	Aransas Pass (reconnaissance)	386	1-9,585	H. S. Stellwagen, U. S. N	1854.
Do	Aransas Bay and Corpus Christi Bayou	995	1-20,000	H. Anderson	1869.
Do	Corpus Christi Pass	994	1-10,000	.....do	1869.
Do	.....do	1288 *b*	1-10,000 1-20,000	R. Wainwright, U. S. N	1875.
Do	Corpus Christi Bay	958	1-20,000	F. F. Nes	1868.
Do	Corpus Christi Bay, Nueces Bay	*1513	1-20,000	R. E. Halter	1882.
Do	Padre Island, east shore	1484 *a*	1-40,000	U. Sebree, U. S. N	1881.
Do	.....do	1484 *b*	1-40,000	.....do	1881.
Do	.....do	1485 *a*	1-40,000	.....do	1881.
Do	.....do	1485 *b*	1-40,000	.....do	1881.
Do	Brazos Santiago, Laguna Madre, south end	909	1-20,000	C. H. Boyd	1867.
Do	Rio Grande entrance	377	1-10,000	J. Wilkinson, U. S. N	1853.
Cuba	El Morro to Playa de Mariano	900	1-10,000	W. S. Edwards	1867.
Nicaragua	Grey Town Harbor	1890	1-5,000	A. Strausz	1865.
	PANAMA TO POINT CONCEPTION, CALIFORNIA.				
United States of Colombia to California.	Panama to San Diego	1202 *a*	1-400,000	P. C. Johnson, U. S. N	1873.
Do	.....do	1202 *b*	1-400,000	.....do	1873.
Do	.....do	1202 *c*	1-400,000	.....do	1873.
Mexico	Tartar Shoal	1966	1-12,272	.....do	1872.
Lower California	Magdalena Bay, Man-of-War Cove to The Narrows	1124	1-40,000	G. Bradford	1871.
Do	Magdalena Bay, The Narrows to Cayuco Cove	1123	1-20,000	.....do	1871.
Do	Guadalupe Island	1598	1-40,000	H. E. Nichols, U. S. N	1881.
California	San Diego to San Francisco (reconnaissance)	289	1-380,000	J. Alden, U. S. N	1851.
Do	.....do	290	1-375,000	.....do	1851.
Do	Boundary Monument to Sand Ridge △	1888	1-20,000	H. B. Mansfield, U. S. N	1888-89.
Do	.....do	1889	1-20,000	.....do	1888-89.
Do	San Diego Bay and vicinity	564	1-10,000	J. Alden, U. S. N	1856.
Do	.....do	565	1-10,000	.....do	1856.
Do	.....do	566	1-10,000	.....do	1856.
Do	.....do	567	1-10,000	.....do	1856.
Do	San Diego Bay, entrance and lower part	1420	1-10,000	G. W. Coffin, U. S. N	1878.
Do	San Diego Bay and Harbor	268	1-10,000	R. D. Cutts, U. S. N	1851.
Do	San Diego Bay, near Point Loma	2185	1-10,000	F. H. Crosby, U. S. N	1894.
Do	Sand Ridge △ to Leucadia △	1905	1-20,000	H. B. Mansfield, U. S. N	1889.
Do	Leucadia △ to Barranca Bluff △	1906	1-20,000	.....do	1889.
Do	Barranca Bluff △ to San Juan Rock	1907	1-20,000	D. Delehanty, U. S. N	1889.
Do	San Juan by the Sea and vicinity	1783	1-10,000	G. Davidson	1887.
Do	San Juan Rock to Newport Landing	1908	1-20,000	D. Delehanty, U. S. N	1889.
Do	Newport Bay to San Pedro Bay	1418	1-20,000	E. H. C. Leutze, U. S. N	1878.
Do	Newport Bay	1256	1-10,000	A. W. Chase	1875.
Do	Newport Creek and vicinity, head of Submarine Valley.	1786	1-10,000	F. Westdahl	1887.

*Topographic number.

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	PANAMA TO POINT CONCEPTION, CALIFORNIA—cont'd.				
California	San Pedro Bay, off shore	1904	1-40,000	D. Delehanty, U. S. N	1889.
Do	San Pedro Bay and Harbor approaches	706 *a*, *b*	1-10,000	J. Alden, U. S. N	1859.
Do	San Pedro Bay and Wilmington Lagoon	1797	1-10,000	F. Westdahl	1887.
Do	San Pedro Bay, anchorage	437	1-10,000	T. H. Stevens, U. S. N	1854.
Do	San Pedro Bay, part of Los Angeles	310	1-10,000	J. Alden, U. S. N	1852.
Do	Point Firmin to Point Vincente	1417	1-20,000	E. H. C. Leutze, U. S. N	1878.
Do	Monica Bay	1341 *a*	1-40,000	H. C. Taylor, U. S. N	1875-76.
Do	Monica Bay, along shore, Point Vincente to Port Ballona.	1340 *b*	1-20,000	do	1876.
Do	Monica Bay, at and near Santa Monica	1341 *b*	1-10,000	do	1875.
Do	Monica Bay, Shoo Fly Landing	1211	1-10,000	P. C. Johnson, U. S. N	1873.
Do	do	2125	1-10,000	F. Westdahl	1893.
Do	Monica Bay, along shore, Santa Monica to Point Dume.	1340 *a*	1-20,000	H. C. Taylor, U. S. N	1876.
Do	Santa Barbara Channel, eastern end	1403	1-40,000	E. H. C. Leutze, U. S. N	1878.
Do	Santa Barbara Channel, projection for speed trial, U. S. S. San Francisco.	2029	1-80,000	D. Delehanty, U. S. N	1890.
Do	West of Point Dume	1405	1-10,000	E. H. C. Leutze, U. S. N	1878.
Do	East of Point Mugu	1404	1-10,000	do	1878.
Do	Point Mugu to Point Hueneme	554	1-10,000	J. Alden, U. S. N	1856.
Do	San Buenaventura and vicinity	503	1-10,000	do	1855.
Do	Santa Barbara Channel, inshore hydrography, Point Los Pitas.	1038	1-10,000	E. Cordell	1869.
Do	Santa Barbara Channel, San Buenaventura and vicinity.	1081	1-10,000	W. A. Greenwell	1870.
Do	Santa Barbara Channel, San Buenaventura to Cape Quemada.	1045	1-100,000	E. Cordell	1869.
Do	Santa Barbara Channel, inshore hydrography, Point Los Pitas to Rincon Point.	1039	1-10,000	do	1869.
Do	Santa Barbara Channel, inshore hydrography, Carpenteria and vicinity.	1040	1-10,000	do	1869.
Do	Santa Barbara Channel, inshore hydrography, Santa Barbara and vicinity.	1041	1-10,000	do	1869.
Do	do	311	1-10,000	J. Alden, U. S. N	1852.
Do	Santa Barbara Channel, inshore hydrography, Santa Barbara and vicinity (proposed light).	436	1-10,000	T. H. Stevens, U. S. N	1854.
Do	Santa Barbara Channel, inshore hydrography, Santa Barbara Light to Goleta Point.	1042	1-10,000	E. Cordell	1869.
Do	Santa Barbara Channel, inshore hydrography, west of Goleta Point.	1043	1-10,000	do	1869.
Do	Santa Barbara Channel, inshore hydrography, vicinity Cañada del Capitan.	1044	1-10,000	do	1869.
Do	Santa Barbara Channel, inshore hydrography, east of Gaviota Wharf.	1342 *b*	1-10,000	F. Curtis, U. S. N	1877.
Do	Santa Barbara Channel, inshore hydrography, Gaviota Wharf to Coxo Anchorage.	1342 *a*	1-10,000	do	1877.
Do	Santa Barbara Channel, inshore hydrography, Point Conception and Coxo Anchorage.	1037	1-10,000	E. Cordell	1869.
Do	do	295	1-20,000	J. Alden, U. S. N	1862.
Do	Santa Barbara Channel, western part, Santa Cruz Island to Point Conception.	1370	1-100,000	F. Curtis, U. S. N	1877.
	ISLANDS OFF COAST OF SOUTHERN CALIFORNIA.				
California	Cortez Bank	355	1-5,000	T. H. Stevens, U. S. N	1853.
Do	do	542	1-40,000	J. Alden, U. S. N	1856.
Do	San Clemente Island	1429	1-20,000	G. W. Coffin, U. S. N	1879.
Do	San Clemente Island, northeast shore	1430	1-20,000	E. H. C. Leutze, U. S. N	1879.
Do	San Clemente Island Anchorage, southeast end	543	1-10,000	J. Alden, U. S. N	1856.
Do	San Clemente Island Anchorage, northwest end	312	1-10,000	do	1852.
Do	Santa Catalina Island, northeast side	1414 *a*	1-20,000	G. W. Coffin, U. S. N	1878.
Do	Santa Catalina Island, southeast side	1414 *b*	1-20,000	do	1878.
Do	Santa Catalina Island, west end	1413	1-20,000	do	1877-78.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	ISLANDS OFF COAST OF SOUTHERN CALIFORNIA—continued.				
California	Santa Catalina Island, Isthmus Cove and Catalina Harbor.	1210	1–10,000	P. C. Johnson, U. S. N.	1873.
Do	Santa Catalina Island, Catalina Harbor	291	1–5,000	J. Alden, U. S. N.	1851.
Do	Santa Catalina Island, Isthmus Cove	308	1–5,000	do	1852.
Do	Santa Barbara Island	1459 *a*	1–10,000	E. H. C. Leutze, U. S. N.	1879.
Do	San Nicolas Island	1459 *b*	1–20,000	do	1879.
Do	Santa Cruz Island, northern side, Smugglers Cove to Diablo Point.	1324 *a*	1–20,000	H. C. Taylor, U. S. N.	1875.
Do	Santa Cruz Island, Prisoners and Chinese harbors	1324 *b*	1–10,000	do	1875.
Do	Santa Cruz Island, Prisoners Harbor	303	1–10,000	J. Alden, U. S. N.	1852.
Do	Santa Cruz Island, east end, and Anacopa Island	501	1–10,000	do	1855.
Do	Santa Cruz Island, south shore, San Pedro Point to Albert Anchorage.	1323 *b*	1–20,000	H. C. Taylor, U. S. N.	1875.
Do	Santa Cruz Island, south shore, Albert Anchorage to Cape Cervada.	1323 *a*	1–20,000	do	1875.
Do	Santa Cruz Island, west and north shores, Cape Cervada to Diablo Point.	1221 *b*	1–20,000	do	1874.
Do	Santa Cruz Channel	1221 *a*	1–20,000	P. C. Johnson, U. S. N.	1873–74.
Do	Santa Rosa Island, south side	1334 *b*	1–20,000	H. C. Taylor, U. S. N.	1875–76.
Do	Santa Rosa Island, north side	1334 *a*	1–20,000	do	1875–76.
Do	San Miguel Passage	1333 *a*	1–20,000	do	1876.
Do	San Miguel Island, west end	1333 *b*	1–20,000	do	1875–76.
Do	San Miguel Island, Cuylers Harbor	309	1–10,000	J. Alden, U. S. N.	1852.
	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON.				
California	Point Conception, western approaches	1371 *a*	1–10,000	F. Courtis, U. S. N.	1877.
Do	Point Arquello and vicinity	1371 *b*	1–10,000	do	1877.
Do	Point Arquello to Point Sal	1470	1–20,000	E. H. C. Leutze, U. S. N.	1880.
Do	Lompoc Landing	1676	1–10,000	G. Davidson	1876.
Do	Point Sal Roadstead	921	1–5,000	E. Cordell	1867.
Do	Point Sal to Oso Flaco	1460	1–10,000	E. H. C. Leutze, U. S. N.	1879–80.
Do	Oso Flaco to San Luis Obispo Bay	1461	1–10,000	do	1879.
Do	San Luis Obispo Bay, off shore	1447	1–100,000	do	1879–80.
Do	San Luis Obispo Bay and approaches	1270	1–10,000	L. A. Sengteller	1875.
Do	San Luis Obispo Bay and vicinity	302	1–10,000	J. Alden, U. S. N.	1852.
Do	Pecho Rock to Point Buchon	1606 *a*	1–10,000	E. D. Taussig, U. S. N.	1884.
Do	Point Buchon to Morro Bay	1606 *b*	1–10,000	do	1884.
Do	Esteros and Morro bays	1607 *a*	1–10,000	do	1884.
Do	Esteros Bay, El Morro to Cayucas Point	1607 *b*	1–10,000	do	1884.
Do	Cayucas Point, Pico Creek	2022	1–20,000	D. Delehanty, U. S. N.	1890.
Do	San Simeon Bay	1611 *a*	1–10,000	E. D. Taussig, U. S. N.	1884.
Do	do	301	1–10,000	J. Alden, U. S. N.	1852.
Do	Piedras Blancas and vicinity to Breakers Point	1611 *b*	1–10,000	E. D. Taussig, U. S. N.	1884.
Do	Ragged Point and vicinity	1612	1–10,000	do	1884.
Do	Ragged Point to Tide Rock	2076	1–20,000	D. Delehanty, U. S. N.	1890–91.
Do	Tide Rock to Andersons Landing	2077	1–20,000	do	1890–91.
Do	Andersons Landing to Cooper Point	2078	1–20,000	do	1891.
Do	Cooper Point to Point Sur	1550	1–10,000	W. S. Swinburne, U. S. N.	1883.
Do	Point Sur to Kaslers Point	1549 *b*	1–10,000	do	1883.
Do	Kaslers Point to Point Carmel	1549 *a*	1–10,000	do	1883.
Do	Point Carmel to Pascadero Point	1548 *b*	1–10,000	do	1883.
Do	Pascadero Point to Point Pinos	1548 *a*	1–10,000	do	1883.
Do	Point Pinos to Cape Mendocino (reconnaissance)	241	1–1,000,000	W. P. McArthur, U. S. N.	1851.
Do	Monterey Bay	558	1–40,000	J. Alden, U. S. N.	1856.
Do	Monterey Bay, Monterey Harbor	296	1–10,000	do	1851.
Do	Monterey Bay, southeast part	559	1–10,000	do	1856.
Do	Monterey Bay, middle part	560	1–10,000	do	1856.
Do	Monterey Bay, northeast part	561	1–10,000	do	1856.
Do	Monterey Bay, Sanquel Cove to Santa Cruz	504	1–10,000	do	1855.
Do	Monterey Bay, Santa Cruz Harbor (reconnaissance).	300	1–10,000	do	1852.
Do	Monterey Bay, Santa Cruz Harbor to Table Rock	379	1–10,000	T. H. Stevens, U. S. N.	1853.
Do	Santa Cruz to Point San Pedro	871	1–100,000	E. Cordell	1865.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON—continued.				
California	Table Rock to Scotts Creek	505	1-10,000	A. MacRae, U. S. N	1855.
Do	Scotts Creek to Point Año Nuevo	506	1-10,000	J. Alden, U. S. N	1855.
Do	Big Gulch to Point Año Nuevo	380	1-10,000	T. H. Stevens, U. S. N	1853.
Do	Point Año Nuevo to Pescadero Creek	555	1-10,000	J. Alden, U. S. N	1856.
Do	Pescadero Creek to Tunitas Creek	556	1-10,000	....do	1856.
Do	Tunitas Creek to Point Miramontes	825	1-10,000	A. F. Rodgers	1863.
Do	Half Moon Bay	821	1-10,000	....do	1863.
Do	Pillar Point to Point San Pedro	835	1-10,000	....do	1863.
Do	San Francisco entrance and approaches	721	1-100,000	J. Alden, U. S. N	1858-59-60.
Do	San Francisco entrance and bar	1201	1-20,000	G. Bradford	1873.
Do	San Francisco entrance	1628	1-20,000	E. D. Taussig, U. S. N	1884.
Do	....do	562	1-80,000	J. Alden, U. S. N	1857.
Do	San Francisco entrance, shoal near Middle Farallon	1298 *b*	1-20,000	G. Bradford	1874.
Do	San Francisco entrance, Hurst Shoal, off South Farallon.	1298 *c*	1-5,000	H. C. Taylor, U. S. N	1876.
Do	San Francisco entrance, North Farallon (examination).	*1831	1-5,000	G. Davidson	1885.
Do	San Francisco entrance and bar	456	1-20,000	J. Alden, U. S. N	1855.
Do	San Francisco Bay, Point Bonita to Angel Island	462	1-10,000	....do	1855.
Do	San Francisco Bay, Golden Gate	*359	1-10,000	R. D. Cutts	1852.
Do	San Francisco Bay, Golden Gate to Hunters Point and Oakland.	1214 *a*	1-20,000	G. Bradford	1871-73.
Do	San Francisco Bay, Presidio to Angel Island	1297	1-10,000	....do	1874.
Do	San Francisco Bay, Angel Island to Berkeley and Hunters Point.	464	1-20,000	J. Alden, U. S. N	1855.
Do	San Francisco Bay and vicinity of the city	347	1-10,000	....do	1853.
Do	....do	604	1-10,000	R. M. Cuyler, U. S. N	1857.
Do	San Francisco Bay, city front and Oakland Creek and approaches.	1522	1-10,000	L. A. Sengteller	1882.
Do	San Francisco Bay, Mission Bay Rock	1883	1-120,000	H. B. Mansfield, U. S. N	1888.
Do	San Francisco Bay, Speed Course	2115	1-10,000	D. Delehanty, U. S. N	1892.
Do	San Francisco Bay, Point Avisadera to Coyote Hill Creek.	628	1-20,000	J. Alden, U. S. N	1857-58.
Do	San Francisco Bay, Point Avisadera to Point San Bruno.	421	1-10,000	....do	1854.
Do	San Francisco Bay, Steinbergen and Redwood City creeks.	637	1-10,000	R. M. Cuyler, U. S. N	1858.
Do	San Francisco Bay, southern part	629	1-10,000	J. Alden, U. S. N	1858.
Do	San Francisco Bay, Coyote Hill and Union City creeks.	638	1-10,000	R. M. Cuyler, U. S. N	1858.
Do	San Francisco Bay, Ravenswood to Coyote Creek	636	1-10,000	J. Alden, U. S. N	1858.
Do	San Francisco Bay, Oakland water front and creek	573	1-10,000	....do	1857.
Do	San Francisco Bay, north of Yerba Buena Island	1214 *b*	1-20,000	G. Bradford	1874.
Do	San Francisco Bay, Angel Island to Castro Rocks	465	1-10,000	J. Alden, U. S. N	1855.
Do	San Francisco Bay, Richmond Bay and Raccoon Strait.	463	1-10,000	....do	1855.
Do	San Francisco Bay, Hospital Cove, Angel Island	1882	1-10,000	L. A. Sengteller	1888.
Do	San Francisco Bay, Castro Rocks to Point San Pedro.	466	1-10,000	J. Alden, U. S. N	1855.
Do	San Pablo Bay	524	1-20,000	R. M. Cuyler, U. S. N	1856.
Do	....do	1801	1-20,000	C. M. Thomas, U. S. N	1887.
Do	San Pablo Bay, Point Wilson and vicinity	1444	1-20,000	G. Bradford	1878-79.
Do	....do	758	1-20,000	B. F. Sands, U. S. N	1862.
Do	....do	781	1-20,000	A. F. Rodgers	1863.
Do	San Pablo Bay, Petaluma Creek, entrance to Lakeville Landing.	724	1-10,000	J. Alden, U. S. N	1860.
Do	San Pablo Bay, Petaluma Creek, Lakeville Landing to Petaluma.	725	1-10,000	....do	1860.
Do	Karquines Strait and Mare Island Navy-Yard approaches.	759	1-10,000	B. F. Sands, U. S. N	1862.
Do	....do	1322	1-5,000	H. C. Taylor, U. S. N	1878.
Do	Mare Island Strait	544	1-10,000	J. Alden, U. S. N	1856.

* Topographic number.

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	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON—continued.				
California	Mare Island Strait	838	1-5,000	A. F. Rogers	1864.
Do	Mare Island Strait (reconnaissance)	236	1-5,000	W. P. McArthur, U. S. N.	1850.
Do	do	288	1-5,000	do	1849.
Do	Napa Creek, Navy-Yard Slough to Napa	723	1-10,000	J. Alden, U. S. N.	1860.
Do	Karquines Strait, Mare Island to Army Point	563	1-10,000	do	1857.
Do	do	1779	1-10,000	D. Peacock, U. S. N	1886.
Do	Karquines Strait, Benicia and vicinity	2021	1-10,000	D. H. Mahan, U. S. N.	1890.
Do	do	782	1-10,000	A. F. Rodgers	1863.
Do	do	760	1-10,000	B. F. Sands, U. S. N	1862.
Do	do	879	1-10,000	E. Cordell	1866.
Do	Suisun Bay, Army Point to Sacramento and San Joaquin rivers.	905	1, 20,000	do	1867.
Do	Suisun Bay, Army Point to Middle Point	1780	1-10,000	D. Peacock, U. S. N	1886-87.
Do	Suisun Bay, Army Point to Honker Bay and Sacramento River mouth.	1438	1-20,000	G. Bradford	1878.
Do	Suisun Bay, Army Point to Roe Island	2025	1-10,000	D. H. Mahan, U. S. N	1890.
Do	Suisun Bay, northern part, Suisun and Montezuma creeks.	1785	1-20,000	D. Peacock, U. S. N	1885.
Do	Suisun Bay, northern part, Suisun, Cordelia, and Montezuma creeks.	948	1-20,000	E. Cordell	1867.
Do	Suisun Bay, Duck Island and vicinity	2023	1, 10,000	D. H. Mahan, U. S. N	1890.
Do	Suisun Bay, Middle Point to Chipps Island and vicinity.	1781	1-10,000	D. Peacock, U. S. N	1886.
Do	Suisun Bay, Sacramento and San Joaquin rivers, entrance.	935	1-10,000	E. Cordell	1867.
Do	do	1784	1-10,000	D. Peacock, U. S. N	1886.
Do	do	2024	1-10,000	D. H. Mahan, U. S. N.	1890.
Do	Ballenas Bay and Duxbury Reef	438	1-10,000	J. Alden, U. S. N.	1854.
Do	Duxbury Reef to Point Reyes	720	1-40,000	do	1860.
Do	Drakes Bay and Point Reyes	435	1-10,000	do	1854.
Do	San Francisco to Crescent City (reconnaissance)	401	1-375,000	do	1854.
Do	Point Reyes to Bodega Head, off shore	889	1-100,000	E. Cordell	1866.
Do	Cordell Bank, off Cape Reyes (replotted 1-20,000)	1298 *a*	1-100,000	G. Bradford	1873.
Do	Point Reyes to Tomales Point	890	1-20,000	E. Cordell	1866.
Do	Tomales Bay, entrance to Prestons Point	756	1-10,000	J. Alden	1860.
Do	Tomales Bay, Prestons Point to Head	757	1-10,000	B. F. Sands, U. S. N	1861.
Do	Bodega Bay, Tomales Point to Bodega Head	806	1-10,000	do	1862.
Do	Bodega Head to Duncans Landing	1462 *a*	1-10,000	G. W. Coffin, U. S. N	1879.
Do	Duncans Landing to Meyer Gulch	1462 *b*	1-10,000	do	1879.
Do	Meyer Gulch to Timber Cove	1463 *a*	1-10,000	do	1879.
Do	Timber Cove, Fort Ross Cove, and sunken rocks off Timber Gulch.	1463 *b*	1-5,000	G. W. Coffin and W. S. Swinburne, U. S. N.	1881.
Do	Timber Cove to Horseshoe Point	1471 *a*	1-10,000	H. E. Nichols, U. S. N.	1880.
Do	Horseshoe Point to 2 miles north of Bihler Landing.	1471 *b*	1-10,000	do	1880.
Do	2 miles north of Bihler Landing to Bowens Landing.	1507 *a*	1-10,000	W. S. Swinburne, U. S. N.	1881.
Do	Bowens Landing to Schooner Gulch	1507 *b*	1-10,000	do	1881.
Do	Schooner Gulch to Point Arena	1508	1-10,000	do	1881.
Do	Point Arena to Irish Gulch	1535	1-10,000	do	1882.
Do	Irish Gulch to Elk Creek	1536	1-10,000	do	1882.
Do	Elk Creek to Whitesboro Landing	1537	1-10,000	do	1882.
Do	Whitesboro Landing to Caspar Point	1586 *a*	1-20,000	E. D. Taussig, U. S. N.	1883.
Do	Mendocino Bay	1228	1-10,000	L. A. Sengteller	1872.
Do	Mendocino Bay and Harbor	384	1-10,000	J. Alden, U. S. N.	1853.
Do	Caspar Point to Newport Landing	1586 *b*	1-20,000	E. D. Taussig, U. S. N.	1883.
Do	Newport Landing to Ussel Rock	1643 *a*	1-20,000	do	1885.
Do	Ussel Rock to Small White Rock	1643 *b*	1-20,000	do	1885.
Do	Small White Rock to Gitchell Creek	1778	1-20,000	do	1885-86.
Do	Shelter Cove and vicinity	1469	1-10,000	H. E. Nichols, U. S. N.	1880.
Do	Shelter Cove	385	1-10,000	J. Alden, U. S. N.	1853.
Do	Gitchell Creek to Punta Gorda	1681	1-20,000	E. D. Taussig, U. S. N.	1886.
Do	Punta Gorda to Cape Mendocino	1682	1-20,000	do	1885-86.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON—continued.				
California	Cape Mendocino to Cape Fortunas	1150	1-20,000	G. Bradford	1872.
California and Oregon.	Cape Mendocino to Coquille River, line of soundings.	242	1-100,000	W. P. McArthur, U. S. N	1851.
California	Cape Fortunas to Humboldt Light	1294	1-20,000	G. Bradford	1875.
Do	Eel River	*1816	1-20,000	G. Davidson	1888.
Do	do	*1136	1-10,000	A. F. Rodgers	1869.
Do	Cape Fortunas to Trinidad	1299	1-100,000	G. Bradford	1872.
Do	Table Bluff to Mad River	1295	1-20,000	do	1875.
Do	Humboldt Bay, approaches, bar, and entrance	1177 *b*	1-10,000	G. Farquhar	1870.
Do	Humboldt Bay and bar	1635	1-20,000	E. D. Taussig, U. S. N	1884.
Do	Humboldt Bay and entrance	710	1-10,000	J. Alden, U. S. N	1859.
Do	Humboldt Bay, channel across bar	1328	1-10,000	G. Bradford	1875.
Do	Humboldt Bay, lower part	270	1-10,000	J. Alden, U. S. N	1851.
Do	do	1176 *a*	1-10,000	G. Farquhar	1871.
Do	Humboldt Bay, upper part	271	1-10,000	J. Alden, U. S. N	1851.
Do	do	1176 *b*	1-10,000	G. Farquhar	1871.
Do	do	1177 *a*	1-10,000	do	1871.
Do	Mad River to Rocky Point	1296	1-20,000	G. Bradford	1875.
Do	Trinidad Bay (reconnaissance)	274	1-6,336	J. Alden, U. S. N	1851.
Do	Trinidad Bay and Harbor	1157	1-10,000	G. Bradford	1872.
Do	Rocky Point to Upper Bluff	1934	1-20,000	D. Delehanty, U. S. N	1889.
Do	Rocky Point to Upper Bluff, off shore	1935	1-20,000	do	1889.
Do	Upper Bluff to False Klamath Rock	1936	1-20,000	do	1889.
Do	Upper Bluff to False Klamath Rock, off shore	1937	1-20,000	do	1889.
Do	False Klamath Rock to Point St. George	1236	1-20,000	H. C. Taylor, U. S. N	1874.
Do	Crescent City Harbor and approaches	690	1-10,000	J. Alden, U. S. N	1859.
Do	Crescent City Harbor	383	1-10,000	do	1853.
Do	do	480	1-10,000	do	1855.
Do	Crescent City Reef	1025 *b*	1-10,000	A. W. Chase	1871.
Do	Crescent City to Smith River	1237	1-20,000	P. C. Johnson and H. C. Taylor, U. S. N.	1873-74.
Do	St. George Reef and vicinity, Point St. George	1025 *a*	1-20,000	A. W. Chase	1869.
California and Oregon.	Crescent City to Columbia River	402	1-375,000	J. Alden, U. S. N	1853.
Do	Profile lines showing general features of bottom	1967	1-60,000	H. C. Taylor, U. S. N	1874.
Do	Smith River to Cape Ferrelo	1239	1-20,000	do	1874.
Oregon	Chetka Cove	1212 *a*	1-10,000	P. C. Johnson, U. S. N	1873.
Do	Goat Island to Mack Arch	1240	1-20,000	H. C. Taylor, U. S. N	1874.
Do	Crooks Point to Euchre Creek	1945	1-20,000	J. M. Helm, U. S. N	1889.
Do	Hunter Cove	1212 *b*	1-10,000	P. C. Johnson, U. S. N	1873.
Do	Euchre Creek to Cape Blanco	1946	1-20,000	J. M. Helm, U. S. N	1889.
Do	Port Orford and vicinity	*1133	1-20,000	A. M. Chase	1869.
Do	Port Orford Harbor	381	1-10,000	J. Alden, U. S. N	1853.
Do	Orford Reef and vicinity	1300	1-20,000	G. Bradford	1871.
Do	Coquille River and entrance	722	1-10,000	J. Alden, U. S. N	1860.
Do	Coos Bay entrance	755	1-10,000	J. S. Lawson	1861.
Do	Coos Bay, Coos Head to North Slough	2047 *a*	1-10,000	E. F. Dickins	1890.
Do	Coos Bay, Fearless Rock and off Empire Mill, special examinations.	2047 *b*	1-5,000	do	1890.
Do	Coos Bay, lower part	902	1-10,000	J. S. Lawson	1865.
Do	Coos Bay, upper part	901	1-10,000	do	1865.
Do	do	2048	1-10,000	E. F. Dickins	1890.
Do	Umpqua Head to Columbia River	240	1-850,000	W. P. McArthur, U. S. N	1851.
Do	Umpqua River and entrance	1759	1-10,000	L. A. Sangteller	1886.
Do	do	382	1-10,000	J. Alden, U. S. N	1853.
Do	Umpqua River, upper part	1746	1-10,000	L. A. Sangteller	1885-86.
Do	Siuslaw River	1588	1-10,000	do	1883.
Do	Yaquina Bay, approaches and entrance	988	1-10,000	A. W. Chase and J. C. Burnett, U. S. N.	1868-88.
Do	Yaquina Bay and River	1764	1-10,000	A. W. Chase	1868.

* Topographic number.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON—continued.				
Oregon	Nestuggah Bay	1587	1-10,000	C. Rockwell	1883.
Do	Examination for reported rocks off Haystack Rock and Cape Lookout.	1995	1-40,000	D. Delehanty, U. S. N.	1889.
Do	Cape Kiwanda to Cape Meares	2080 *a*	1-20,000	J. M. Helm, U. S. N.	1891.
Do	Cape Kiwanda to Cape Meares, off shore, and Netart Bay.	2088 *b*	1-20,000	.....do	1891.
Do	Cape Meares to Cape Falcon	1722	1-40,000	A. S. Snow and J. C. Burnett, U. S. N.	1885-87.
Do	Tillamook Bay and approaches	936	1-10,000	J. Kincheloe	1866-67.
Do	.....do	1723	1-10,000	A. S. Snow and J. C. Burnett, U. S. N.	1885-87.
Do	Nehalem River	973	1-5,000	E. Cordell	1868.
Oregon and Washington.	Cape Falcon to Columbia River entrance	1378	1-40,000	G. W. Coffin, U. S. N	1877.
Do	Columbia River entrance to Willapa Bay	1379	1-40,000	.....do	1877.
Do	Columbia River entrance	336	1-20,000	J. Alden, U. S. N.	1852.
Do	.....do	250	1-20,000	W. P. McArthur, U. S. N	1850.
Do	.....do	273	1-20,000	.....do	1851.
Do	.....do	1019	1-20,000	E. Cordell	1868.
Do	.....do	428	1-20,000	J. Alden, U. S. N.	1854.
Do	Columbia River entrance, South Channel Bar	429	1-10,000	.....do	1854.
Do	Columbia River, Cape Disappointment to Tongue Point.	1018	1-20,000	E. Cordell	1868.
Oregon	Columbia River, Tansy Point to Tongue Point	1930	1-10,000	C. Rockwell	1889.
Do	Columbia River, Lewis and Clarkes and Youngs rivers.	1931	1-10,000	.....do	1889.
Oregon and Washington.	Columbia River, Tongue Point to Yellow Bluffs	1017	1-10,000	E. Cordell	1868.
Do	.....do	1725	1-10,000	A. S. Snow, U. S. N.	1885.
Do	Columbia River, Grays Bay to Three Tree Point	1015	1-10,000	E. Cordell	1868.
Oregon	Columbia River, Settlers Point to Cathlamet Head	1016	1-10,000	.....do	1868.
Oregon and Washington.	Columbia River, Welchs Island to Puget Island	1335	1-10,000	J. J. Gilbert	1875-76.
Do	Columbia River, Puget Island to Crims Island	1336	1-10,000	.....do	1876.
Do	Columbia River, Crims Island to Mount Coffin	1368	1-10,000	.....do	1877.
Do	Columbia River, Walker Island and vicinity	1724	1-10,000	A. S. Snow, U. S. N.	1885.
Do	Columbia River, Mount Coffin to Coffin Rock	1369 *a*	1-10,000	J. J. Gilbert	1877.
Do	Columbia River, Coffin Rock to Deer Island	1369 *b*	1-10,000	.....do	1870.
Do	Columbia River, Deer Island to Columbia City	1524	1-10,000	C. Rockwell	1881.
Do	Columbia River, Columbia City to Bachelor Island	1711	1-10,000	.....do	1886.
Do	Columbia River, Bachelor Island to Hewlitts Point	1671	1-10,000	.....do	1885.
Do	Columbia and Willamette rivers, Hewlitts Point to Haydens Island and St. Johns.	1673	1-10,000	.....do	1885.
Oregon	Columbia and Willamette rivers, St. Johns to Ross Island.	1672	1-10,000	.....do	1885.
Oregon and Washington.	Columbia River to Point Greenville	334	1-221,360	J. Alden, U. S. N.	1852.
Do	Columbia River to Cape Flattery	427	1-214,690	.....do	1852.
Washington	Willapa Bay approaches	1799	1-20,000	J. C. Burnett, U. S. N.	1887.
Do	.....do	335	1-20,000	J. Alden, U. S. N.	1852.
Do	.....do	2104	1-20,000	J. M. Helm, U. S. N.	1891.
Do	Willapa Bay, approaches to Tokeland	2046	1-20,000	.....do	1890.
Do	Willapa Bay, Toke Point to Oysterville and Willapa River to Narrows.	2045	1-20,000	.....do	1890.
Do	Willapa Bay, Willapa River, mouth to Narrows	2106	1-10,000	.....do	1890.
Do	Willapa Bay, Willapa River, Narrows to Willapa City	2105	1-10,000	.....do	1891.
Do	Willapa Bay, Leadbetter Point to head of bay	2103	1-20,000	.....do	1891.
Do	Willapa Bay, southern part	498	1-18,818	J. Alden, U. S. N.	1855.
Do	Willapa Bay, Diamond City and vicinity	2044	1-20,000	J. M. Helm, U. S. N.	1890.
Do	Willapa Bay to Grays Harbor	1800	1-40,000	J. C. Burnett, U. S. N.	1887.
Do	Grays Harbor entrance	2085	1-20,000	J. M. Helm, U. S. N.	1891.

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State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON—continued.				
Washington	Grays Harbor entrance	809	1-20,000	J. S. Lawson	1862.
Do	do	1589 *a*	1-20,000	T. D. Bolles and J. M. Helm, U. S. N.	1883-91.
Do	Grays Harbor, North Bay to South Aberdeen	1589 *b*	1-20,000	do	1883-91.
Do	Point Greenville to Port Townsend (reconnaissance)	333	1-214,240	J. Alden, U. S. N.	1852.
Do	Greenville Harbor	426	1-10,000	do	1854.
Do	Jo Creek to Arch Island	2201	1-40,000	F. H. Crosby, U. S. N.	1894.
Do	Arch Island to Destruction Island	2202	1-40,000	do	1894.
Do	Destruction Island to Quillihute River	2203	1-40,000	do	1894.
Do	Destruction Island and vicinity	886	1-10,000	J. S. Lawson	1866.
Do	James Island to White Rock	2096	1-40,000	D. Delehanty, U. S. N.	1891.
Do	Flattery Rocks to Neah Bay	1845	1-40,000	J. C. Burnett, U. S. N.	1888.
Do	Cape Flattery to Neah Bay	1881	1-10,000	do	1888.
Do	Strait of Juan de Fuca, Neah Bay	337	1-10,000	J. Alden, U. S. N.	1853.
Do	Strait of Juan de Fuca, Port San Juan to Pysht River	2170	1-80,000	L. Flynne, U. S. N.	1893.
Do	Strait of Juan de Fuca, Pysht River to Whidbey Island.	1629	1-80,000	A. S. Snow, U. S. N.	1884.
Do	Strait of Juan de Fuca, False Dungeness (Port Angeles).	325	1-10,000	J. Alden, U. S. N.	1852.
Do	Strait of Juan de Fuca, Port Angeles	2148	1-10,000	A. S. Snow, U. S. N.	1884.
Do	do	*2110	1-4,800	J. J. Gilbert	1892.
Do	do	*2109	1-4,800	do	1892.
Do	Strait of Juan de Fuca, Port Angeles to San Juan Island.	2211	1-40,000	L. Flynne, U. S. N.	1894.
Do	Strait of Juan de Fuca, San Juan Island to Admiralty Inlet.	2212	1-40,000	do	1894.
Do	Strait of Juan de Fuca, Rosario and Haro straits, south entrances.	433	1-100,000	J. Alden, U. S. N.	1854.
Do	Strait of Juan de Fuca, New Dungeness	500	1-10,000	do	1854.
Do	Strait of Juan de Fuca and Admiralty Inlet entrance.	1534	1-20,000	T. D. Bolles, U. S. N.	1882.
Do	do	1516 *b*	1-20,000	P. Garst, U. S. N.	1881.
Do	Strait of Juan de Fuca, Partridge Bank	1130	1-20,000	J. S. Lawson	1871.
Do	Strait of Juan de Fuca, Smith Island	431	1-10,000	J. Alden, U. S. N.	1854.
Do	Strait of Juan de Fuca, Admiralty Inlet to Rosario Strait.	1886	1-20,000	H. P. Mayo, U. S. N.	1888.
Do	Strait of Juan de Fuca, Port Discovery and Washington Harbor approaches.	1516 *a*	1-20,000	P. Garst, U. S. N.	1881.
Do	Puget Sound, Admiralty Inlet	510	1-100,000	J. Alden, U. S. N.	1855.
Do	Puget Sound, Admiralty Inlet, Admiralty Head to Foulweather Bluff.	1729	1-20,000	C. T. Forse, U. S. N.	1886.
Do	Puget Sound, Admiralty Inlet, Port Townsend	434	1-10,000	J. Alden, U. S. N.	1854.
Do	do	*2072	1-4,800	J. J. Gilbert	1891.
Do	do	*2071	1-4,800	do	1891.
Do	Puget Sound, Admiralty Inlet, Oak Bay, and Kilisut Harbor.	1482 *a*	1-10,000	P. Garst, U. S. N.	1880.
Do	Puget Sound, Admiralty Inlet, Port Ludlow	508	1-10,000	J. Alden, U. S. N.	1855.
Do	Puget Sound, Hoods Canal entrance	1482 *b*	1-10,000	P. Garst, U. S. N.	1880.
Do	Puget Sound, Hoods Canal, Port Gamble to Hood Point.	1483	1-20,000	do	1880.
Do	Puget Sound, Hoods Canal, Port Gamble	509	1-10,000	J. Alden, U. S. N.	1855.
Do	Puget Sound, Hoods Canal, Dabop Bay	1640 *b*	1-20,000	J. N. Jordan, U. S. N.	1884.
Do	Puget Sound, Hoods Canal, Quatsap Point to Lilliwaup Bay.	1640 *a*	1-20,000	C. T. Forse, U. S. N.	1885.
Do	Puget Sound, Hoods Canal, Lilliwaup Bay to head of canal.	1695	1-20,000	do	1885.
Do	Puget Sound, Double Bluff to Battery Point	1338 *a*	1-40,000	J. S. Lawson	1875.
Do	Puget Sound, Useless Bay, Deer Lagoon	1338 *b*	1-10,000	G. Bradford	1876.
Do	Puget Sound, Possession Sound to Meadow Point and Pilot Point to President Point.	1344	1-10,000	do	1876.
Do	Puget Sound, Port Madison	1102	1-10,000	J. S. Lawson	1868.

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	POINT CONCEPTION, CAL., TO NORTHWEST BOUNDARY, WASHINGTON—continued.				
Washington	Puget Sound, Port Orchard, Dyes Inlet, and Dogfish Bay.	1694	1-20,000	C. T. Forse, U. S. N	1885.
Do	Puget Sound, Port Orchard Naval Station	*2196	1-1,000	J. J. Gilbert	1895.
Do	Puget Sound, Port Orchard Naval Station (proposed site).	*1951	1-5,000	J. F. Pratt	1889.
Do	Puget Sound, Bainbridge Island, east side	1337 *a*	1-10,000	J. S. Lawson	1875.
Do	Puget Sound, Port Blakely	525	1-10,000	J. Alden, U. S. N	1856.
Do	Puget Sound, Duwamish Bay	1337 *b*	1-10,000	J. S. Lawson	1875.
Do	.....do	432	1-10,000	J. Alden, U. S. N	1854.
Do	Puget Sound, Shilshole Bay	*1064	1-10,000	J. S. Lawson	1867.
Do	Puget Sound, Battery Point to Point Piner and north end Colvos Passage.	1425 *a*	1-20,000	R. M. Cutts, U. S. N	1878.
Do	Puget Sound, Point Piner to Fox Island and south end Colvos Passage.	1426 *a*	1-20,000	.....do	1878.
Do	Puget Sound, Quartermasters Harbor	1425 *b*	1-10,000	.....do	1878.
Do	Puget Sound, Commencement Bay	1381	1-10,000	.....do	1877.
Do	Puget Sound, Steilacoom Harbor and vicinity	499	1-10,000	J. Alden, U. S. N	1855.
Do	Puget Sound, Fox Island to Hendersons Inlet	1426 *b*	1-20,000	R. M. Cutts, U. S. N	1879.
Do	Puget Sound, Carrs Inlet, Hales and Pitt passages	1445 *a*	1-20,000	A. B. Wyckoff, U. S. N	1875.
Do	Puget Sound, Cases Inlet, southern part, to head of Eld and Tottens inlets.	1446 *a*	1-20,000	R. M. Cutts, U. S. N	1879.
Do	Puget Sound, Cases Inlet, northern part	1445 *b*	1-20,000	A. B. Wyckoff, U. S. N	1875.
Do	Puget Sound, Hammersleys Inlet	1446 *b*	1-10,000	.....do	1879.
Do	Puget Sound, Brisco Point to Olympia	1301	1-10,000	J. S. Lawson	1873-74.
Do	Puget Sound, Olympia and vicinity	507	1-10,000	J. Alden, U. S. N	1855.
Do	.....do	*2073	1-4,800	J. J. Gilbert	1891.
Do	.....do	*2074	1-4,800	.....do	1891.
Do	Possession Sound	1728	1-20,000	C. T. Forse, U. S. N	1886.
Do	Possession Sound, Port Susan	1730	1-20,000	.....do	1886.
Do	Saratoga Passage	1884	1-20,000	H. T. Mayo, U. S. N	1888.
Do	Saratoga Passage to Skagit Bay	1885	1-20,000	.....do	1888.
Do	Skagit Bay	2050	1-20,000	J. N. Jordan, U. S. N	1890.
Do	Skagit Bay, La Conner Harbor	*2108	1-4,800	J. J. Gilbert	1892.
Do	Padilla and Samish bays	1815	1-20,000	C. T. Forse, U. S. N	1887.
Do	Anacortes Harbor, eastern approaches	*2111	1-4,800	J. J. Gilbert	1892.
Do	Anacortes Harbor	*2112	1-4,800	.....do	1892.
Do	Anacortes Harbor, western approaches	*2113	1-4,800	.....do	1892.
Do	Bellingham Bay	1887	1-20,000	H. T. Mayo, U. S. N	1888.
Do	Bellingham Bay, northern part	502	1-20,000	J. Alden, U. S. N	1855.
Do	Bellingham Bay, Fairhaven Harbor	*2070	1-5,000	J. J. Gilbert	1891.
Do	Bellingham Bay, New Whatcom Harbor	*2069	1-5,000	.....do	1891.
Do	Rosario and Haro straits, south entrance	405	1-200,000	J. Alden, U. S. N	1853.
Do	Rosario Strait entrance, Lawson Reef	1129	1-10,000	J. S. Lawson	1871.
Do	Rosario Strait, southern part, and Bellingham Channel.	1814	1-20,000	C. T. Forse, U. S. N	1887.
Do	Rosario Strait, northern part	1953	1-20,000	J. N. Jordan, U. S. N	1889.
Do	Lopez Pass and waters between Rosario and Haro straits.	2114	1-20,000	W. P. Ray, U. S. N	1891.
Do	San Juan Channel, Shaw Island and vicinity	2213	1-10,000	L. Flynne, U. S. N	1894.
Do	San Juan Channel, north entrance	2214	1-10,000	.....do	1894.
Do	Haro Strait, Henry Island and vicinity	2216	1-10,000	.....do	1894.
Do	Haro Strait, Stuart Island and vicinity	2215	1-10,000	.....do	1894.
Do	Haro Strait, north entrance	2113	1-20,000	W. P. Ray, U. S. N	1891.
Do	Haro and Rosario straits, north entrance	708	1-20,000	J. Alden, U. S. N	1858.
Do	Gulf of Georgia, southern part	709	1-100,000	.....do	1858-59.
Do	Gulf of Georgia, Matia Islands to Birch Point	2079	1-20,000	J. N. Jordan, U. S. N	1891.
Do	Gulf of Georgia, north of Patos Islands	2080	1-20,000	.....do	1891.
Do	Gulf of Georgia, Boundary Bay	2049	1-20,000	.....do	1890.
Do	Gulf of Georgia, Semiahmoo Bay	1954	1-10,000	.....do	1889.
Do	.....do	603	1-20,000	R. M. Cuyler, U. S. N	1857.

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	SOUTHEAST ALASKA.				
Alaska	Port Simpson and vicinity and north part Chatham Sound (for approximation of longitude).	1617	1-80,000	H. E. Nichols, U. S. N.	1883.
Do	Portland Canal and vicinity (hydrography and topography).	1891	1-80,000	C. M. Thomas, U. S. N.	1888.
Do	Portland Inlet and vicinity	1899	1-40,000	do	1888.
Do	Portland Canal	1900	1-40,000	do	1888.
Do	Portland Canal, head of Bear and Salmon River Flats (hydrography and topography).	1893	1-20,000	do	1888.
Do Do	Portland Canal harbors Portland Canal harbors (hydrography and typography). Wales Harbor Winter Harbor Somerville Bay Hidden Inlet Halibut Bay Fords Cove	1895 1892	1-13,333 1-10,000 1-5,000 1-20,000 1-10,000 1-5,000	C. M. Thomas, U. S. N. do	1888. 1888.
Do	Portland Canal and vicinity, Willard Inlet	1896	1-20,000	do	1888.
Do	Portland Canal and vicinity, Willard Inlet (hydrography and topography).	1894	1-20,000	do	
Do	Portland Canal to Cape Fox	1614	1-40,000	H. E. Nichols, U. S. N.	1883.
Do	Portland Canal, Revillagigedo Channel, Felice Strait, and Nichols Passage.	1618 *a*	1-80,000	do	1883.
Do	Port Tongass	1618 *b*	1-10,000	do	1883.
Do	Revillagigedo Channel, south entrance, Dundas Island to Mary Island.	2142	1-80,000	W. P. Ray, U. S. N.	1892.
Do	Revillagigedo Channel, Duke Point to Bold Island	1619 *a*	1-40,000	H. E. Nichols, U. S. N.	1882.
Do	Revillagigedo Channel, Ray Anchorage	2143	1-10,000	W. P. Ray, U. S. N.	1892.
Do	Revillagigedo Channel, Danger Passage and vicinity	2144	1-10,000	do	1892.
Do	Revillagigedo Channel, Boca de Quadra	2149	1-20,000	W. I. Moore, U. S. N.	1892.
Do	Revillagigedo Channel and southeast entrance Behm Canal to Eddystone Rock.	2109	1-40,000	H. B. Mansfield, U. S. N.	1891.
Do	Revillagigedo Channel and Tongass Narrows	1512 *b*	1-200,000	H. E. Nichols, U. S. N.	1881.
Do	Revillagigedo Channel, Hoy Rocks to Pennock Island	1620 *a*	1-20,000	do	1882.
Do	Mary Island, custom-house and vicinity	2084	1-5,000	H. B. Mansfield, U. S. N.	1891.
Do	Mary Island, anchorage, north end	1619 *b*	1-5,000	H. E. Nichols, U. S. N.	1882.
Do	Hassler Harbor	1620 *b*	1-5,000	do	1882.
Do	Thorne Arm	* 2060	1-40,000	H. B. Mansfield, U. S. N.	1891.
Do	Carroll and George inlets	2111	1-40,000	do	1891.
Do	Carroll and George Inlets, Great Cove and Tsa Cove	* 2061	1-10,000	do	1891.
Do	Tongass Narrows, Pennock Island to Point Higgins	1621 *a*	1-20,000	H. E. Nichols, U. S. N.	1882.
Do	Tongass Narrows, Wards Cove	1512 *a*	1-4,183	T. D. Bolles, U. S. N.	1881.
Do	do	1621 *b*	1-5,000	H. E. Nichols, U. S. N.	1882.
Do	Tongass Narrows	1512 *c*	1-200,000	do	1881.
Do	Dixon entrance and south entrance Clarence Strait	1649 *a*	1-80,000	R. Clover, U. S. N.	1885.
Do	Howkan and vicinity	1525 *a*	1-10,000	H. E. Nichols, U. S. N.	1881.
Do	Sealed Passage	2145	1-20,000	W. P. Ray, U. S. N.	1892.
Do	Felice and Nichols passages, Revillagigedo Channel and adjacent waters.	1622	1-80,000	H. E. Nichols, U. S. N.	1883.
Do	Tamgas Harbor	1615 *a*	1-20,000	do	1883.
Do	Port Chester	1615 *b*	1-20,000	do	1883.
Do	Clarence Strait, Moira Sound to Union Bay	1649 *b*	1-80,000	R. Clover, U. S. N.	1885.
Do	Clarence Strait, Niblack Anchorage	1650 *a*	1-10,000	do	1885.
Do	Clarence Strait, Chasina Anchorage	1650 *b*	1-5,000	do	1885.
Do	Clarence Strait, Vallenar Bay	1651 *a*	1-20,000	do	1885.
Do	Clarence Strait, Twelve Mile Arm	1652 *a*	1-40,000	do	1885.
Do	Clarence Strait, Karta Bay	1652 *b*	1-5,000	do	1885.
Do	Clarence Strait, Tolstoi Bay	1653 *a*	1-20,000	do	1885.
Do	Clarence Strait, Union Bay	1653 *b*	1-20,000	do	1885.
Do	Behm Canal, southeast entrance to Eddystone Rock	2109	1-40,000	H. B. Mansfield, U. S. N.	1891.
Do	Behm Canal, Eddystone Rock to Burroughs Bay	2108	1-40,000	do	1891.
Do	Behm Canal, Shoalwater Pass, Paks and Fitzgibbon coves.	* 2062	1-20,000	do	1891.
Do	Behm Canal, Rudyerd Bay and Walker Cove	2112	1-20,000	do	1891.

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	SOUTHEAST ALASKA—continued.				
Alaska	Behm Canal, Smearton Bay and Traitors Cove	2110	1-20,000	H. B. Mansfield, U. S. N.	1891.
Do	Behm Canal, Behm Narrows to Point Francis	2107	1-40,000	do	1891.
Do	Behm Canal, Bell Arm, McDonald Bay, and Convenient Cove.	*2063	1-20,000	do	1891.
Do	Clarence Strait and adjacent waters, Lemesurier Point to Stikine River.	1742	1-80,000	A. S. Snow, U. S. N.	1886.
Do	Clarence Strait and adjacent waters, Triangulation, Union Bay to Wrangell.	1743	1-80,000	do	1886.
Do	Clarence Strait, Dewey Anchorage to McHenry Inlet.	1739	1-20,000	do	1886.
Do	Clarence Strait, Ratz Harbor	1744	1-10,000	do	1886.
Do	Clarence Strait, Coffman's Cove	1745	1-10,000	do	1886.
Do	Clarence Strait, Steamer Bay	1740	1-20,000	do	1886.
Do	Wrangell Island, Etolin Harbor and Highfield Anchorage.	1741	1-10,000	do	1886.
Do	Wrangell Island, Etolin Harbor	1623 *a*	1-5,000	H. E. Nichols, U. S. N.	1882.
Do	Sumner Strait, entrance to north end	1749	1-80,000	J. M. Helm, U. S. N.	1886.
Do	Sumner Strait, entrance to north end (triangulation sketch).	1749	1-80,000	do	1886.
Do	Sumner Strait (rough sheet)	1752	1-80,000	do	1886.
Do	do	1753	1-80,000	do	1886.
Do	do	1754	1-80,000	do	1886.
Do	Sumner Strait, Port McArthur	1756	1-10,000	do	1886.
Do	Sumner Strait, Shakan Strait	1757	1-20,000	do	1886.
Do	Sumner Strait, Port Protection	1755	1-10,000	do	1886.
Do	Sumner Strait, Red Bay	1758	1-10,000	do	1886.
Do	Keku Strait, Sumner Strait to Frederick Sound	2150	1-40,000	do	1892.
Do	Keku Strait, Hamilton and Chapin bays and Seclusion Harbor.	2151	1-10,000	do	1892.
Do	Keku Strait, Saginaw and Security bays	2152	1-20,000	do	1892.
Do	Frederick Sound and adjacent waters, Zarembo Island to Cape Fanshaw.	1804	1-80,000	C. M. Thomas, U. S. N	1887.
Do	Frederick Sound and adjacent waters, Zarembo Island to Cape Fanshaw (rough sheets).	1806	1-80,000	do	1887.
Do	Frederick Sound and adjacent waters, Zarembo Island to Cape Fanshaw (triangulation sheets).	1805	1-80,000	do	1887.
Do	Duncan Canal entrance	1807	1-10,000	do	1887.
Do	Duncan Canal, middle part	1808	1-10,000	do	1887.
Do	Duncan Canal, northern part	1809	1-10,000	do	1887.
Do	Zarembo Island, St. John Harbor	1738	1-20,000	A. S. Snow, U. S. N.	1886.
Do	Wrangell Strait	1737	1-30,000	do	1886.
Do	Wrangell Strait (reconnaissance)	1616	1-20,000	J. B. Coghlan, U. S. N	1884.
Do	Wrangell Strait	1525 *b*	1-25,550	H. E. Nichols, U. S. N	1881.
Do	Frederick Sound, Brown Cove	1810	1-5,000	C. M. Thomas, U. S. N.	1887.
Do	Frederick Sound, Thomas Bay	1811	1-20,000	do	1887.
Do	Frederick Sound, Portage Bay	1813	1-10,000	do	1887.
Do	do	1623 *b*	1-10,000	H. E. Nichols, U. S. N.	1882.
Do	Frederick Sound, Farragut Bay	1812	1-20,000	C. M. Thomas, U. S. N	1887.
Do	Frederick Sound, Cleveland Passage	2000	1-10,000	H. B. Mansfield, U. S. N.	1889.
Do	Frederick Sound, Fanshaw Bay	1768	1-10,000	H. E. Nichols, U. S. N.	1885.
Do	Frederick Sound and Stephens Passage	1996	1-80,000	H. B. Mansfield, U. S. N.	1889.
Do	Frederick Sound, Eliza and Woewodski harbors	1998	1-10,000	do	1889.
Do	Pybus Bay	2002	1-40,000	do	1889.
Do	Hobart and Windham bays		1-20,000		
Do	Stephens Passage, Gambier Bay	1997	1-20,000	do	1889.
Do	Stephens Passage and Seymour Canal	2001	1-80,000	do	1889.
Do	Stephens Passage and Seymour Canal, Mole and Windfall harbors.	2003	1-20,000	do	1889.
Do	Stephens Passage, Holkham Bay	1999	1-40,000	do	1889.
Do	Stephens Passage, Midway Islands to Douglas Island and Taku River.	1897	1-80,000	C. M. Thomas, U. S. N	1888.
Do	Stephens Passage, Port Snettisham	1898 *a*	1-30,000	do	1888.

*Topographic number.

List of original hydrographic sheets, geographically arranged, registered in the archives of the United States Coast and Geodetic Survey, etc.—Continued.

State.	Localities.	Registered number.	Scale.	Hydrographer.	Date.
	SOUTHEAST ALASKA—continued.				
Alaska	Stephens Passage, Port Snettisham (hydrography and topography).	1921	1-30,000	C. M. Thomas, U. S. N	1888.
Do	Stephens Passage, Limestone Inlet	1898 *e*	1-5,000	....do	1888.
Do	Stephens Passage, Limestone Inlet (hydrography and topography).	1923	1-5,000	....do	1888.
Do	Stephens Passage, Taku Harbor	1898 *d*	1-5,000	....do	1888.
Do	Stephens Passage, Taku Harbor (hydrography and topography).	1922	1-5,000	....do	1888.
Do	Stephens Passage, Slocum Inlet	1898 *c*	1-10,000	....do	1888.
Do	Stephens Passage, Oliver Inlet	1898 *b*	1-20,000	....do	1888.
Do	Stephens Passage, Oliver Inlet (hydrography and topography).	1924	1-10,000	....do	1888.
Do	Stephens Passage, southern part (hydrography and topography).	1919	1-80,000	....do	1888.
Do	Stephens Passage, northern part (hydrography and topography).	1920	1-80,000	....do	1888.
Do	Stephens Passage, Taku Inlet	2055	1-40,000	H. B. Mansfield, U. S. N	1890.
Do	Stephens Passage, Chatham Strait		1-80,000		
Do	Stephens Passage, Gastineau Channel	2058	1-20,000	....do	1890.
Do	Stephens Passage, Fritz Cove		1-40,000		
Do	Stephens Passage and Lynn Canal	2056	1-40,000	....do	1890.
Do	....do	1602 *a*	1-40,000	J. B. Coghlan, U. S. N	1884.
Do	Stephens Passage and Lynn Canal, Barlow Cove, William Henry Harbor and Taiya Shanka.	2059	1-10,000	H. B. Mansfield, U. S. N	1890.
Do	Lynn Canal, St. James Bay	2060	1-20,000	....do	1890.
Do	Lynn Canal, Berners Bay	2061	1-20,000	....do	1890.
Do	Lynn Canal, northern part	2057	1-40,000	....do	1890.
Do	Cross Sound, Bartlett Cove, and Leo Anchorage	1602 *b*	1-20,000	J. B. Coghlan, U. S. N	1884.
Do	Chatham Strait, Funter Bay and Swanson Harbor	2062	1-10,000	H. B. Mansfield, U. S. N	1890.
Do	Chatham Strait, Cube Point to Danger Point	2205	1-80,000	W. I. Moore, U. S. N	1894.
Do	Chatham Strait, Tenakee Inlet and upper end Freshwater Bay.	2206	1-40,000	....do	1894.
Do	Chatham Strait, Freshwater Bay, lower end	2207	1-20,000	....do	1894.
Do	Chatham Strait, Killisnoo and vicinity	2208	1-10,000	....do	1894.
Do	Peril Strait, Broad Island to Suloia Point	1627	1-20,000	J. B. Coghlan, U. S. N	1884.
Do	Peril Strait, Suloia Point to Sitka	1626	1-20,000	....do	1884.
Do	Sitka Sound and approaches	2175	1-40,000	W. I. Moore, U. S. N	1893.
Do	Sitka Sound, Sitka approaches	2176	1-20,000	....do	1893.
Do	Sitka Sound, Sitka and vicinity	2174	1-10,000	....do	1893.
Do	....do	1439 *a*	1-15,000	L. A. Beardslee, U. S. N	1879.
Do	....do	1449 *b*	1-15,000	....do	1879.
Do	....do	1449 *c*	1-15,000	....do	1879.
Do	Sitka Sound, Sitka and vicinity (compiled)	1449 *d*	1-15,000	....do	1879.
Do	Sitka Sound, Silver Bay	2177	1-20,000	W. I. Moore, U. S. N	1893.
Do	Sitka Sound, Symonds Bay	1440 *a*	1-5,760	L. A. Beardslee, U. S. N	1879.
Do	....do	1440 *b*	1-5,760	....do	1879.
Do	Sitka Sound, Symonds Bay (compiled)	1440 *c*	1-5,760	....do	1879.
Do	Yakutat Bay and entrance	2158	1-40,000	G. B. Harber, U. S. N	1892.
Do	Yakutat Bay, Yakutat and vicinity	2157	1-20,000	....do	1892.
Do	Yakutat Bay, northern part	2159	1-40,000	....do	1892.

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